Service Manual

Bear Cub 750PSV

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Revision History

Date	Revision	Pages	Changes
June 2003	A	All	Release
May 2004	B	All	Release manual in VIASYS Healthcare template using VIASYS Healthcare Critical Care nomenclature.

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CAUTION

Federal law (USA) restricts this device to sale by or on the order of a physician.

CAUTION

Not suitable for use in the presence of flammable anesthetics.

CAUTION

Service and/or repair of this instrument is restricted to VIASYS Healthcare authorized or VIASYS Healthcare Trained Personnel only.

Warranty

The Bear Cub 750PSV is warranted to be free from defects in material and workmanship and to meet the published specifications for One (1) year from date of shipminent.

The liability of VIASYS Healthcare, Critical Care Division, (referred to as the Company) under this warranty is limited to replacing, repairing or issuing credit, at the discretion of the Company, for parts that become defective or fail to meet published specifications during the warranty period; the Company will not be liable under this warranty unless (A) the Company is promptly notified in writing by Buyer upon discovery of defects or failure to meet published specifications; (B) the defective unit or part is returned to the Company, transportation charges prepaid by Buyer; (C) the defective unit or part is received by the Company for adjustment no later than four weeks following the last day of the warranty period; and (D) the Company's examination of such unit or part shall disclose, to its satisfaction, that such defects or failures have not been caused by misuse, neglect, improper installation, unauthorized repair, alteration or accident.

Any authorization of the Company for repair or alteration by the Buyer must be in writing to prevent voiding the warranty. In no event shall the Company be liable to the Buyer for loss of profits, loss of use, consequential damage or damages of any kind based upon a claim for breach of warranty, other than the purchase price of any defective product covered hereunder.

The Company warranties as herein and above set forth shall not be enlarged, diminished or affected by, and no obligation or liability shall arise or grow out of the rendering of technical advice or service by the Company or its agents in connection with the Buyer's order of the products furnished hereunder.

Limitation of Liabilities

This warranty does not cover normal maintenance such as cleaning, adjustment or lubrication and updating of equipment parts. This warranty shall be void and shall not apply if the equipment is used with accessories or parts not manufactured by the Company or authorized for use in writing by the Company or if the equipment is not maintained in accordance with the prescribed schedule of maintenance.

The warranty stated above shall extend for a period of One (1) year from date of shipment, with the following exceptions:

1. Components for monitoring of physical variables such as temperature, pressure, or flow are warranted for ninety (90) days from date of receipt.
2. Elastomeric components and other parts or components subject to deterioration, over which the Company has no control, are warranted for sixty (60) days from date of receipt.
3. Internal batteries are warranted for ninety (90) days from the date of receipt.

The foregoing is in lieu of any warranty, expressed or implied, including, without limitation, any warranty of merchantability, except as to title, and can be amended only in writing by a duly authorized representative of the Company.

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Chapter 1: Specifications

Modes

A/C

In the Assist/Control position, a mechanical breath is delivered with each inspiratory effort, provided the patient satisfies the assist sensitivity criteria. If the patient does not meet the assist sensitivity criteria, the ventilator automaticallydelivers breaths according to the Ventilator Rate control. Mechanical breaths may then be either patient initiated (assisted) or ventilator initiated (controlled).

SIMV/IMV

In the SIMV/IMV position, a combination of mechanical and spontaneous breath types is available. Mechanical breaths, either assisted or controlled, are delivered at the set ventilator rate while all other breaths are spontaneous. Disabling the assist sensitivity mechanism. or removing the flow sensor from the ventilator, will cause the equivalent of IMV mode of ventilation to exist.

CPAP

In the CPAP position, the Base Flow control establishes the continuous flow available for spontaneous breathing.

STANDBY

The STANDBY position discontinues all electrical controls and functions with the exception of the charging system for the internal battery.

NOTE

If the ventilator is connected to air and O2 sources, blended gas will circulate while ventilator is in the STANDBY position, making gas available from the Auxiliary Gas Outlet. The amount of gas flow circulating is determined by the Base Flow setting.

Controls

Rate

Range:	1 to 150 BPM
Resolution:	1 from 1 to 100BPM
	2 from 100 to 150 BPM
Tolerance:	Greater of ± 1 BPM or 0.02 seconds applied to the Breath Interval

Inspiratory Time

Range:	0.10 to 3.0 seconds
Resolution:	0.01 from 0.10 to 0.50 seconds
	0.02 from 0.50 to 1.70 seconds
	0.05 from 1.70 to 3.00 seconds
Accuracy:	± 0.02 seconds from 0.10 to 0.50 seconds
	± 0.025 seconds from 0.50 to 3.00 seconds

Inspiratory Flow

Range:	1 to 30 L/min
Resolution:	0.5 L/min from 1 to 10 L/min
	1.0 L/min from 10 to 30 L/min
Accuracy:	Pressures 0 to 60 cmH2O: ± 0.5 L/min or ± 10% of setting, whichever is greater.
	Pressure 60 to 72 cmH2O: ± 0.5 L/min or + 10%/- 15% of setting, whichever is greater.

Baseline Flow

Range:	1 to 30 L/min
Resolution:	0.5 L/min from 1 to 10 L/min
	1.0 L/min from 10 to 30 L/min
Accuracy:Pressures	0 to 60 cmH2O: ± 0.5 L/min or ± 10% of setting, whichever is greater.
	Pressure 60 to 72 cmH2O: ± 0.5 L/min or + 10%/- 15% of setting. Whichever is greater

Volume Limit™

Range:	5 to 300 ML
Resolution:	1 ML from 5 to 50 ML
	2 ML from 50 to 150 ML
	5 ML from 150 to 300 ML
Accuracy:	± 2 ML or ± 10% of setting, whichever is greater

PEEP

Range:	0 to 30 cmH2O
Resolution:	1 cmH2O
Repeatability:	± 1 cmH2O or ± 5%, whichever is greater

Inspiratory Pressure

Range: 0 to 72 cmH2O

Resolution: 1 cmH2O from 0 to 30 cmH2O

2 cmH2O from 30 to 72 cmH2O

Repeatability: ± 1 cmH2O or ± 5% whichever is greater. Breath to breath

Manual Breath

Range: X1

Assist Sensitivity

Range: 0.2 to 5.0 L/min

Resolution: 0.2 at 0.2 L/min increasing to 0.5 at 5.0 L/min

Accuracy:Not a calibrated scale, minimum setting accuracy is ± 0.1 L/min

Over Pressure Relief

Range: (Pressure at the patient wye): 15

to 75 cmH2O

Resolution: 2 cmH2O stability (repeatability) ±4 cmH2O

$\%0_2$ Blending

Range: 21 to 100% Oxygen concentration

Resolution: 1%

Accuracy: ± 3% oxygen

APNEA Interval

Range: 5, 10, 20, or 30 seconds

Accuracy: ± 1 second

Alarms

Alarm Loudness

Range: Min. to Max. 60 to 75 db(A)

High Breath Rate

Range: 3 to 255 BPM

Low PEEP/CPAP

Range: -5 to 30 cmH2O

Low Inspiratory Pressure

Range: 1 to 65 cmH2O

Patient Circuit

LED On/Off

Failed to Cycle

LEd On/Off

Low Gas Supply

LED On/Off

Apnea

LED On/Off

Settings Incompatible

LED On/Off

Pressure Settings Incompatible

LED On/Off

Prolonged Inspiratory Pressure

LED On/Off

Flow Sensor

LED On/Off

Low Battery

LED On/Off

Alarm Silence

60 seconds

Visual Reset

Push Button

High Pressure Limit

Range: 10 to 75 cmH2O

Line Power

Green/Red LED

Monitors

Total Breath Rate

Range:	0 to 255 BPM
Resolution:	1 BPM from 0 to 100 BPM
	2 BPM from 100 to 150 BPM
	3 BPM from 150 to 255 BPM

Exhalation Minute Volume

Range:	0 to 30.0 L/min
resolution:	0.01 L/min from o to 1.00 L/min
	0.02 L/min from 1 to 2.00 L/min
	0.05 L/min from 2 to 5.0 L/min
	0.10 L/min from 5 to 10.0 L/min
	0.20 L/min from 10 to 30.0 L/min
Accuracy:	Accuracy of the exhaled minute volume is a function of both volume and breath rate. To evaluate the performance of this monitor the accuracy of both tidal volume and breath rate must be combined

Exhaled Tidal Volume

Range:	0 to 500 ML
Resolution:	0.1 ML from 0.0 to 99.9 ML
	1.0 ML from 100 to 500 ML
Accuracy:	± 1 ML or ± 10%, whichever is greater

% of Tubing Leakage

Range:	0 to 100%
Resolution:	1%
Accuracy:	± 2% or ± 1 ML

Inspiratory Time

Range:	0 to 3.10 seconds
Resolution:	0.01 seconds
Accuracy:	± 0.02 seconds

Expiratory Time

Range: 0 to 99.9 seconds

Resolution: 0.01 seconds from 0 to 99.9 seconds

0.10 seconds from 10.0 to 99.9 seconds

Accuracy: ± 0.02 seconds

I:E Ratio

Range: 9.9:1 to 1:9.9

Accuracy: ± 0.1 or ± 20 mseconds, whichever is greater

Peak Inspiratory Pressure

Range: 0 to 99 cmH2O

Resolution: 1 cmH2O

Accuracy: ± 2 cmH2O or ± 5% of reading, whichever is greater

Mean Airway Pressure

Range: 0 to 75 cmH2O

Resolution: 0.5 cmH2O

Accuracy: ± 2 cmH2O or ± 3% of reading, whichever is greater

Inlet O_2 Pressure

Range: 0 to 100 PSIG

Resolution: 1 PSIG

Accuracy: ± 5 PSIG

Proximal Airway Pressure

Range: -10 to 100 cmH2O

Resolution: 1 cmH2O

Accuracy: ± 1 cmH2O from -10 to 20 cmH2O

± 2 cmH2O from 20 to 65 cmH2O

± 3 cmH2O from 65 to 100 cmH2O

Hourmeter

Range: 0 to 99,999 hours

Resolution: 0.1 hour

Accuracy: ± 2% of reading

Breath Type (Patient Initiated)

LED

Test

Push Button

Battery

LED On/Off

Preset Values

Minimum Expiratory Time	150 milliseconds
Maximum Inspiratory Time	3.10 seconds
Maximum settable I:E Ratio	4:1
Model	9300
Classification	Class 1
Degree of Protection	
Electric Shock	Type B
Harmful Ingress of Water	None (Ordinary Equipment)
Degree of Safety of Application	
in Presence of Flammable Anesthetics	None
Mode of Operation	Continuous

Emissions/Susceptibility

This ventilator has been tested to conform to the following specifications:

MIL-STD-461D:1993,MIL-STD-462D:1993, EN55011:1991, IEC 1000-4-2:1994, IEC 1000-4-3:1994, IEC 1000-4-4:1994, IEC 1000-4-5:1994, QUASI-STATIC:1993

This ventilator is designed and manufactured to comply with the safety requirements of IEC 601-1, IEC 601-2-12, CAN/CSA-C22.2 No. 601.1-M90, and UL 2601-1.

Outputs

Digital

(see Section 10, Page 1)	RS-232 Bi-Directional

Analog

Proximal Pressure	-10 to 100 cmH2O, 1 cmH2O/25 mv

Proximal Inspiratory/Expiratory Flow	-40 (expiratory) to 40 (inspiratory) L/min, 1 L/min/50 mv
Breath Phase	1 “Logic” signal; 0, 5V
Remote Nurse Call	0.5 amps max at 24 vdc max

Pneumatic

Auxiliary Blended Gas Outlet	7 to 17 psig, 0 to 8 L/min

Inputs

Electrical

Supply Ratings

Voltage:	100V	80 to 110 VAC
	120V	96 to 132 VAC
	220V*	176 to 242 VAC
	240V	192 to 264 VAC
Current:	100V	1.0 A maximum
	120V	1.0 A maximum
	220V	0.5 A maximum
	240V	0.5 A maximum
Frequency:	100V	50/60 Hz
	120V	50/60 Hz
	220V	50/60 Hz
	240V	50/60 Hz
Fuses:	100/120V	T 0.5 A, 5 x 20 mm
	230/240V	T 0.25 A, 5 x 20 mm

* For 220V operation, set the power entry module selector switch to 230V setting.

Pneumatic

Oxygen and Air	30 to 80 psig, 50 L/min Supply Ratings

Physical Dimension and Shipping Information

Ventilator Weight	27 lbs., 12 kg
Graphics Display Weight	5.5 lbs.
Pedestal Stand Weight	9 lbs.
Compressor Weight	110 lbs.

Ventilator Dimensions	13.5" W x 10" D x 11" H
Graphics Display Dimensions	13" W x 2.5" D x 9.5" H
Pedestal Stand Dimensions	24" x 40.5" H
Compressor Dimensions	22"W x 21.5"D x 36" H

Shipping Weight Including Ventilator	38 lbs.
Graphics Display	11 lbs.
Pedestal Stand	12 lbs.
Compressor	122 lbs.

Shipping Dimensions

Ventilator	18" W x 18" D x 19" H
Graphics Display	16" W x 13" D x 11" H
Pedestal Stand	25" W x 5" D x 45" H
Compressor	26" W x 22" D x 40" H

Environmental Specifications

Temperature

Storage and Shipping	-40 to 158 ºF (-40 to 70 ºC)
Checkout and Operating	50 to 104 ºF (10 to 40 ºC)

Altitude

Checkout, Operating, Transport and Storage	0 to 9,000 feet (14.7 to 10.5 PSIA/760 to 543 mm Hg)

Humidity

Storage and Shipping	0 to 99% Relative Humidity — Non-condensing
Checkout and Operating	0 to 95% Relative Humidity — Non-condensing

Method of Sterilization/Disinfection

NOTE

See also the BEAR CUB™ 750vs Infant Ventilator Instruction Manual Cleaning and Maintenance (section 7)

Cleaning

External Surfaces

All external surfaces of the ventilator shall be able to be wiped clean with the following compounds:

A.	Isopropyl Alcohol	
B.	Chlorine Compounds	Maximum Concentration: 1:10
C.	Quaternary Ammonium Compounds	Maximum Concentration: 1:500

NOTE

These compounds are diluted by volume in water.

Sterilization

All parts of the ventilator that can come in contact with the patient expiratory gas and all parts of the breathing circuit external to the ventilator shall be sterilizable or disposable.

Methods of Sterilization

Ethylene oxide, maximum temperature 130 ºF (54 ºC)

Steam sterilization, maximum temperature 250 ºF (121 ºC)

Liquid Sterilization

1. Cidex

Minimum sterilization cycles before part replacement:

1. Patient Circuit, Exhalation Manifold:

Ethylene Oxide	240 cycles
Steam Sterilization	240 cycles
Liquid Sterilization	240 cycles

2. Flow Sensor:

Ethylene Oxide	6 months
Liquid Sterilization	6 months
Pasteurization (using mesh bag)	6 months

3. All other sterilization components:

Ethylene Oxide	120 cycles or 1 year
Steam Sterilization	120 cycles or 1 year
Liquid Sterilization	120 cycles or 1 year

Chapter 2: Theory of Operation

Overview

This section describes the operating theory of the BEAR CUB™ 750vs Infant Ventilator. The BEAR CUB™ 750vs ventilator can be classified as a micro-processor controlled, time cycled, pressure limited, dual flow, neonatal/pediatric critical care ventilator. Breaths are initiated either by the ventilator (controlled), by patient activity (assisted), or by the operator (manual).

The top level block diagram (figure 2-1) graphically illustrates the overall structure of the ventilator.

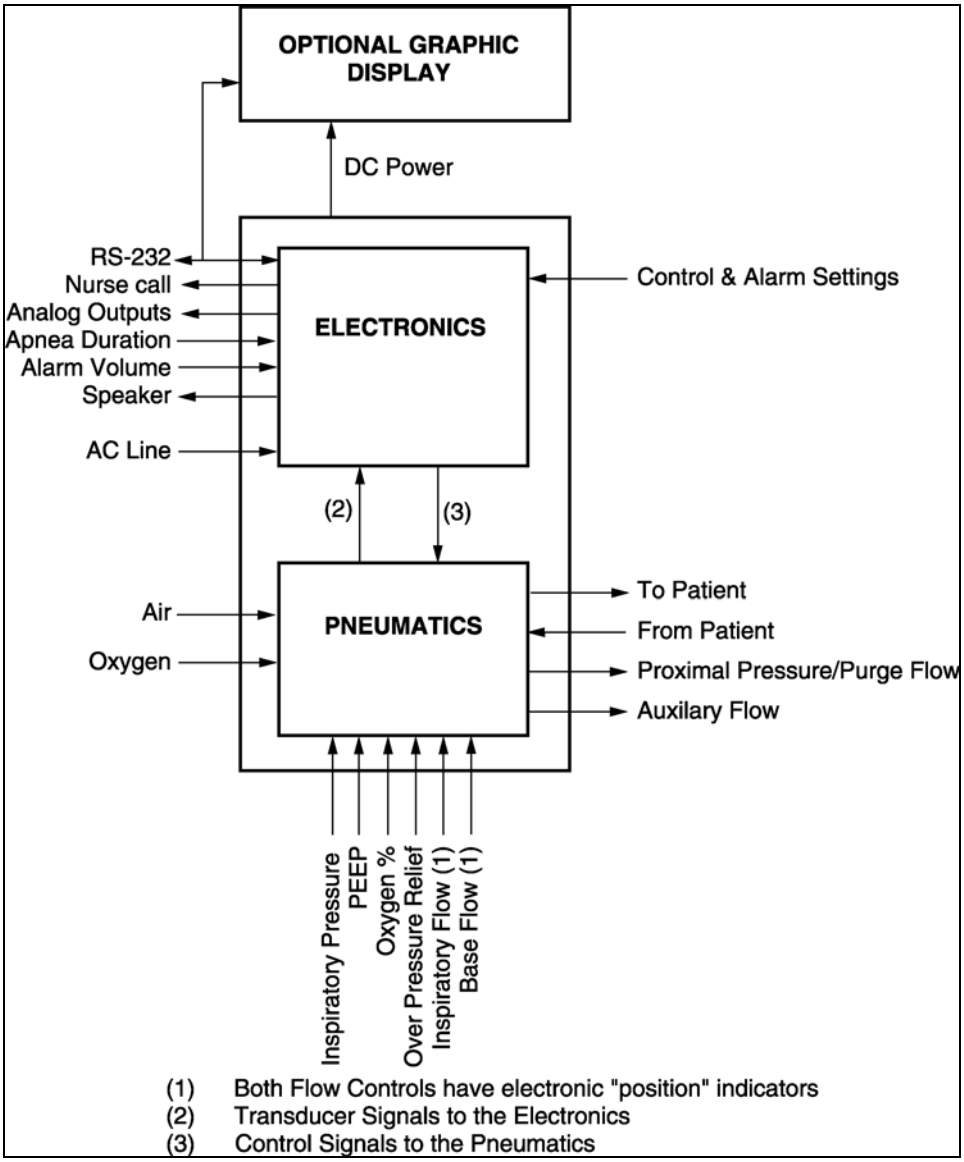


Figure 2-1: Top Level Block Diagram

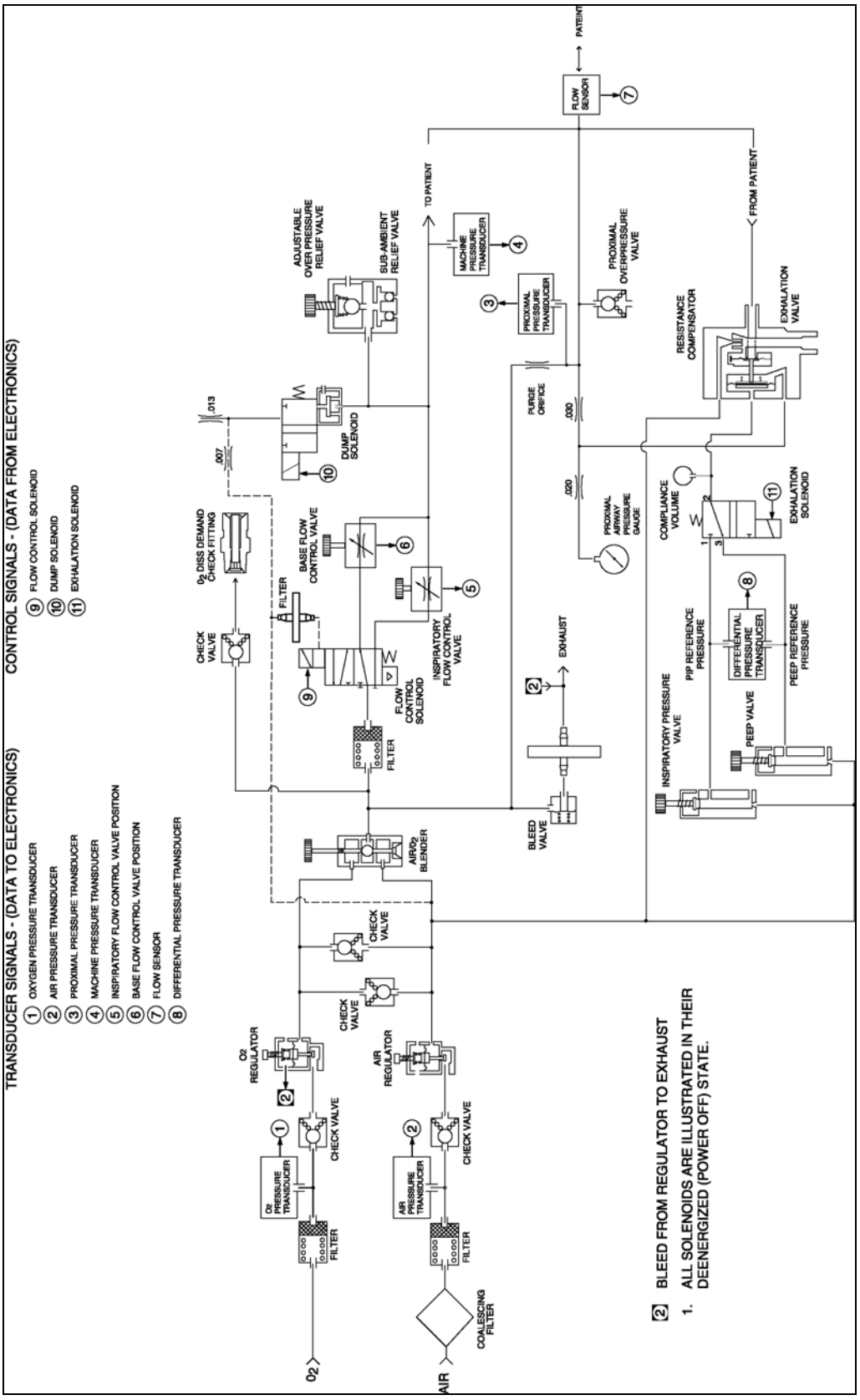


Figure 2-2: Pneumatics System Schematic

Ventilator pneumatics - General description

Figure 2-2 shows the schematic diagram of the BEAR CUB™ 750vs Pneumatics System. The pneumatics interface to the electronics is achieved using various actuators (solenoids) and transducers. The Pneumatics System consists of eight (8) main subsystems: Gas Inlet and Conditioning, Oxygen Blender System, Flow Control, Sub-Ambient/Overpressure Relief system, Exhalation Valve/Pressure Control, Pressure Monitoring, the Proximal Airway Purge System, and the Auxiliary Gas Outlet.

Gas Inlet Conditioning

Compressed air and oxygen sources, supplied in the pressure range of 30 to 80 psig, are connected to the standard DISS male-threaded fittings on the back panel of the ventilator.

Incoming air passes through a coalescing filter housed in the Air Inlet Water Trap. Particulate matter down to .3 micron in size, and aerosols down to .75 micron, are trapped. Both gases, air and O2, pass through sintered metal filters.

Supply pressures are monitored and displayed by the ventilator via pressure transducers and the system electronics. The system will trigger an alarm if either Air or O_2 pressure drops below 24(±2) psig, and the alarm will reset when the pressures are above 30 psig.

From the Air Inlet Water Trap and internal filters, the air and oxygen enter the in-line, one way Check Valves which prevent flow from exiting through an inlet if that source is removed.

Blender

Air and O_2 pressure are regulated to 17 psig and are balanced to each other for accurate blending of gases in the O_2 blender.

In the event of a failure of either of the supply gases, one of a pair of crossover check valves will open to permit continued operation. Oxygen blending will not be maintained in this condition, and the patient gas flow and pressure may decrease, by less than 10%, depending on settings.

To ensure accurate oxygen blending at low patient flow rates, a bleed valve maintains a minimum flow through the blender.

Flow Control Valve

Two flow control valves are switched by a solenoid valve to create Inspiratory and Base Flow. Each valve controls flow from 1 to 30 L/min. Each flow control valve is geared to a potentiometer. The potentiometer provides an electronic signal to the microprocessor; this flow is then displayed on the front panel corrected to set barometric pressure.

NOTE

The Inspiratory Flow and Base Flow displayed on the Front Panel are independent of the flow readings taken by the flow sensor.

AOPR Valve/Sub-Ambient Valve/ Dump Solenoid

Maximum pressure to the patient can be limited using the Adjustable/Over Pressure Relief valve. The mechanical, user adjustable, pressure relieving valve can be set from 15 cmH_2O to 75 cmH_2O. A patient effort of -3 cmH_2O allows the patient to breathe air through the Sub-Ambient valve.

A Dump Solenoid is activated upon detection of an obstruction in the expiratory leg of the patient circuit. Activation of the solenoid opens the Dump Valve to the atmosphere. The solenoid is controlled by software which monitors system pressures. Depending upon flow rate, patient circuit pressure will drop to 5 cmH_2O or less.

Auxiliary Gas Outlet

The auxiliary gas outlet provides blended gas for use with a nebulizer, or for manual ventilation. The connection of auxiliary gas is achieved via a DISS O_2 fitting. To inhibit overpressure in the system due to a mistaken connection to high pressure oxygen supply, a check valve in line allows only one direction of flow. Auxiliary gas flow levels can range from 0 to 8 L/min. This flow will not be interrupted by a disruption in electrical power (therefore, use of a manual resuscitation bag could be initiated if needed).

Pressure Control System

The BEAR CUB™ 750vs Infant Ventilator ventilates the patient between two pressure levels: Positive End Expiratory Pressure (PEEP) and Peak Inspiratory Pressure (PIP). Inspiratory Pressure must always be above the PEEP pressure for ventilation to occur. The PIP pressure is manually set by the user at a level of 0 to 72 cmH_2O (measured at the patient wye). The PEEP valve can be set from 0 to 30 cmH_2O. A solenoid valve switches reference pressure to the Exhalation Valve. An exhalation assist jet venturi compensates for flow resistance in the exhalation limb of the patient circuit to allow 0 cmH_2O PEEP setting at up to 10 L/min of Base Flow (to less than 4 cmH_2O at 20 L/min). At low levels of Base Flow, the PEEP control must be set appropriately to prevent negative patient circuit pressures.

The patient circuit has a proximal airway line for monitoring patient pressure. This proximal airway line provides a link to the control electronics and software. It also functions as a pneumatic servo control line to the exhalation valve. Only tubing that is 1/8 inch in diameter is to be used in the proximal airway system. Any other diameter tube may cause patient circuit pressure to become less stable.

A purge flow (100ml/min) of blended gas through the proximal airway tube is used to prevent the migration of moisture and patient contamination into the ventilator.

Exhalation Valve

The Exhalation Valve regulates flow out of the patient circuit. Exhaled patient gases flow through the expiratory leg of the patient circuit, past the Exhalation Valve diaphragm and seat, and out to the atmosphere. The Exhalation Valve is a pneumatic servo controlled regulator. Within the Exhalation Valve, Proximal pressure and Control pressure (which alternates between PIP and PEEP reference pressure depending on the breath phase) are separated by a Control diaphragm. If Control pressure is higher than Proximal pressure, the Control diaphragm will move the control pin to close the Exhalation Valve diaphragm. When Proximal pressure equals PIP/PEEP Control pressure, the diaphragm will open slightly to maintain the PIP/PEEP level. At exhalation, Control pressure drops to PEEP reference pressure which causes the Control diaphragm to retract the control pin opening the Exhalation Valve diaphragm. Proximal pressure then drops to the PEEP level and stabilizes.

Flow Sensor

The BEAR CUB™ 750vs Infant Ventilator flow sensor reads gas flow while sensing flow direction. The flow is calibrated to 37 °C, ambient pressure, and assumes 100% humidity. Inhaled flows, exhaled flows, and volumes are monitored with control electronics through the flow sensor. The flow sensor enables the ventilator to trigger a breath based upon inspired flow. The patient effort (in L/min) required to initiate a breath can be adjusted (.2 to 5 L/min) using the assist sensitivity setting. The flow sensor also enables the ventilator to display on the front panel the percentage of endotracheal tube leak based upon inhaled and exhaled volume measurements.

The flow sensor operates on the principle of hot wire anemometry. The hot wire flow sensing system is a constant temperature device. The bidirectional operation is achieved with two platinum wires. The two wires are positioned in the same plane with a pin installed between them. The upstream wire will cool more rapidly than the downstream wire. Therefore more current will be required to maintain a constant preset temperature. The electronics interprets this higher current in the upstream wire to determine both flow and flow direction. This measured flow rate is then integrated over time by the ventilator's microprocessor to yield inhaled and exhaled volumes.

The flow sensor reads from 0.2 to 40 L/min, calibrated from 0.2 to 25 L/min, and indicates to 40 L/min. Each Flow Sensor Cable Assembly contains an electronic memory circuit (an E2PROM) which stores calibration data for the unit. Therefore, the sensor will function with the electronic circuit of any BEAR CUB™ 750vs Infant Ventilator without the need for a system calibration.

Ventilator Electronics

The major components of the electronics system include the Display PCB, the Control PCB, and the Power Supply.

The Display circuit board is the user interface for the ventilator electronics. Ventilator controls and alarms are set by the clinician, and Monitors feed current ventilator status back to the display.

The Control circuit board includes the Monitor MCU and Control MCU. The Control board drives the system solenoids which control breath phase, flow, and pressure. This is achieved using front-panel settings from the display board, as well as incorporating its own real-time pressure and flow readings. The Control board also enables bidirectional (digital) communication to the optional Graphic Display in order to chart ventilator data. Also, analog outputs proportional to pressure and flow, plus a breath phase signal are provided to the back panel. The electronics to drive and read the flow sensor are also contained on the Control PCB.

Power Supply

The Power Supply converts the AC line voltage to DC voltages for the electrical system. AC line voltages of 100, 120, 230, and 240 volts (at frequencies from 50 to 60 Hertz) can be used as input power. Five DC voltages are used in the ventilator electronics: 5, 7, 10, -10 and 22 VDC. All power levels that are high enough to pose an ignition hazard in the presence of oxygen concentrations greater than 21% are housed in a separate enclosure from the rest of the system. If input power fails, a 12 volt rechargeable, sealed, lead-acid battery is included to provide a minimum of 30 minutes of ventilator operation. A two-level battery charger circuit is contained on the Power Supply PCB in order to keep the battery on continuous charge whenever the ventilator is plugged into an AC outlet.

Ventilator Software

The BEAR CUB™ 750vs Infant Ventilator is a shared processor system, incorporating two Motorola 68HC11 microcontroller units (MCU), the Monitor and the Controller. Each processor, and thereby its software, have specific and duplicated tasks. Each processor is based on a 2.5 m-sec timer interrupt, referred to as a 'tick.' The Controller directs basic control of the ventilator based on operational settings communicated from the Monitor MCU, as well as on pressure transducer, and flow sensor data read on its own 8 bit Analog to Digital (A/D) converter. The Monitor has the following functions: (1) reads the front panel switches, back panel switches, and potentiometers, (2) monitors ventilator performance as well as the performance of the Controller MCU, (3) transmits front panel status to the Controller, (4) receives performance data back from the Controller, and (5) transmits display data and annunciator status to the front panel.

During power-up, both processors perform RAM (Random Access Memory), and ROM (Read Only Memory) tests to verify integrity of these two memory systems. Solenoid and Control Potentiometer continuity are also tested during power-up by the Control and Monitor processors respectively. Continuous communication checks between the two processors are used to verify functionality of each sub-system. If an error is detected, either processor has the ability to shutdown the ventilator while enabling the audible and visual Failed to Cycle alarms. These systems, among others, are provided to reduce the possibility of a software/hardware error leading to an undetected hazardous condition.

Chapter 3 OVP Recommended Service

Operational Verification

Operational Verification should be performed between patient use or a minimum of once each month. Verification may be done by a qualified operator, Allied Healthcare Trained Hospital Service Technician or Allied Healthcare Technician. Verification is intended to be done in the hospital. If done by an Allied Healthcare Technician, there will be a charge.

Certain procedures such as a verification of the alarm circuits should be performed at least once every 24 hours that the unit is in clinical use. Refer to the BEAR CUB™ 750vs Infant Ventilator instruction manual for details.

Do not use the ventilator unless it passes all the steps in the Operational Verification Procedure.

Equipment Required

Infant Test Lung	P/N 52000-40027
Patient Circuit	P/N 50000-01147
Oxygen Analyzer	
Rubber Stopper	
Stop Watch	

CAUTION

If any of the following procedures fail to producer the results as outlined in this document, disconnect the ventilator and contact your authorized VIASYS Healthcare service technician.

Table 3-1: Standard Settings

Mode	SIMV
Rate	30 BPM
Inspiratory Pressure	40 cmH2O
Inspiratory Flow	15 L/min
PEEP/CPAP	0 cmH2O
Inspiratory Time	0.8 seconds
Base Flow	5 L/min
Assist Sensitivity	MAX
O2%	21%
Apnea	10 seconds
Low PEEP/CPAP Alarm	-3 cmH2O
Volume Limit™	300 ml
High Pressure Limit	50 cmH2O
Low Inspiratory Pressure Alarm	30 cmH2O
High Breath Rate Alarm	40 BPM

Table 3-2: Rate

Set Rate	Inspiratory Time	Using stop watch verify Breath Rate
10 BPM	3 seconds	10 ± 2 BPM
40 BPM	1 second	40 ± 3 BPM
80 BPM	0.4 seconds	80 ± 4 BPM
120 BPM	0.1 seconds	120 ± 6 BPM

Table 3-3: Exhalation Time and I/E Ratio Table

Rate	Set Inspiratory time	Verify Exhalation Time	Verify I/E Ratio
10 BPM	3.00 seconds	3.0 ± 0.4 sec	1:1.0 ± 0.3
75 BPM	0.40 seconds	- - - - - - - -	1:1.0 ± 0.3
150 BPM	0.10 seconds	- - - - - - - -	1:3.0 ± 0.4

WARNINGS

The following warnings must be read and understood before performing the procedures described in this section.

- Under no circumstances should this medical device be operated in the presence of flammable anesthetics or other volatile materials due to a possible explosion hazard.
- Liquid spilled or dripped into the unit may cause damage to the unit or result in an electrical shock hazard.
- Oxygen vigorously accelerates combustion. To avoid violent ignition, do not use any gauges, valves, or other equipment that has been exposed to oil or grease contamination.
- Do not release this medical device if any alarm/alert function is inoperative. To do so could result in a malfunction without warning, possibly resulting in personal injury, including death or property damage. Refer the unit to a Allied Healthcare Authorized Service Technician or a Allied Healthcare Trained Hospital Service Technician.
- All tubing and fittings used to connect high pressure gas (air and oxygen) from the source to the test equipment and from the test equipment to the device being tested must be capable of withstanding a minimum supply pressure of 100 psi (7.03 kg/cm2). The use of tubing and fittings not capable of withstanding this pressure could cause the tubing to rupture, resulting in personal injury or property damage.
- When verifying the operation of this medical device, do not breathe directly from the machine. Always use a fresh bacterial filter and test circuit. A hazard to the health of the service person may result.
- If any of the following procedures cannot be verified as outlined in this document, do not use this device on a patient and refer it to Allied Healthcare or a Allied Healthcare Authorized Service Facility or a Allied Healthcare Trained Hospital Service Technician.

CAUTIONS

- Do not sterilize the ventilator. The internal materials are not compatible with sterilization techniques.
- Do not use MEK or Trichloroethylene, as damage to surface may result. Do not allow any liquid to spill or drip into the ventilator.
- Circuit boards are subject to damage by static electricity. Do not touch components, circuit, or connector fingers with hands. Handle only by edges.

Before using any test equipment [electronic or pneumatic] for calibration procedures [other than operational verification], the accuracy of the instruments must be verified by a testing laboratory. The laboratory master test instruments must be traceable to the NIST (National Institute of Standards Technology) or equivalent. When variances exist between the indicated and actual values, the calibration curves [provided for each instrument by the testing laboratory] must be used to establish the actual

correct values. This certification procedure should be performed at least once every six months. More frequent certification may be required based on usage and…..???

Test Procedures

1. Set up the ventilator with a standard infant test circuit. Plug the end of circuit with rubber stopper.
2. Set the ventilator to standard settings per Table A. Ensure overpressure relief valve is set to maximum pressure. Connect air, oxygen, and AC power to ventilator.
3. Press the TEST button, verify all indicators and digits illuminate.
4. Verify rates per Table B. While doing rate verification you will get a rate alarm. Press the alarm silence button. Verify that the audible alarm is silenced and the silence is canceled after 60 seconds ± 10%. Return to standard settings. Set mode to Assist Control.
5. Verify Exhalation Time and I:E Ratio per Table C. Return to standard settings.
6. Adjust Inspiratory Pressure to 25 cmH_2O. Verify activation of Low Pressure alarm.
7. Increase Inspiratory Pressure to 50 cmH_2O. Verify High Pressure alarm and limit.
8. Return Inspiratory Pressure to 40 cmH_2O. Push the Visual Reset button and verify that the Low Pressure and High Pressure LEDs are canceled.
9. Occlude patient circuit limb going to the exhalation valve. Verify that a prolonged inspiratory alarm occurs.
10. Increase ventilator rate to 45 BPM. Verify that the High Rate alarm activates.
11. Decrease rate to 4 BPM. Verify that the apnea alarm activates.
12. Set ventilator rate to 70 BPM. Verify that the Incompatible Setting alarm activates. Return rate to 30 BPM.
13. Push the Pressure Selector button to read air pressure. Verify reading is within 5 PSI of input pressure.
14. Push the Pressure Selector button to read O_2 Pressure. Verify reading is within 5 PSI of O_2 supply pressure.
15. Disconnect air supply. Verify that the Low Gas Supply alarm activates. Reconnect air supply.
16. Disconnect O_2 supply. Verify that the Low Gas Supply alarm activates.
17. Disconnect the air supply. Verify that the fail to cycle alarm activates. Reconnect the air and O_2 supplies.
18. Connect an O_2 analyzer inline. Verify that the FIO_2 is within ± 3% at the following settings: 21%, 60%, 100%. Remove O_2 analyzer.
19. Adjust the rate to 10 BPM. Turn the Low PEEP/CPAP alarm to 5 cmH_2O. Verify that the Low PEEP/CPAP alarm activates. Return the Low PEEP/CPAP alarm to -3 cmH_2O.
20. Disconnect the AC power. Verify that the audible alarm activates and the line power LED illuminates red within 10 seconds. Push the Visual Reset button.

Verify that the audible alarm is canceled and the unit continues to function. Reconnect the AC power.

21. Connect the circuit to the infant test lung. Set the Volume Limit to 25ml. Verify That the tidal Volume readout is 25 ml ± 20%.
22. Disconnect the Flow Sensor cable from the ventilator. Verify that the flow sensor alarm activates, assist sensitivity window is blank, and that the monitored volume and volume limit displays show dashes. Reconnect the flow sensor cable, verify audible alarm cancels, assist sensitivity window illuminates, and volume digits return.
23. Turn Assist Sensitivity to MIN. Squeeze and release the patient circuit. Verify that the unit will assist and that Patient Initiated LED is illuminating.
24. Disconnect the patient circuit from the test lung. Verify that both audible and visual Low Inspiratory Pressure alarms are activated. Verify that the Alarm Loudness can be varied from minimum to maximum, but the alarm cannot be turned off.

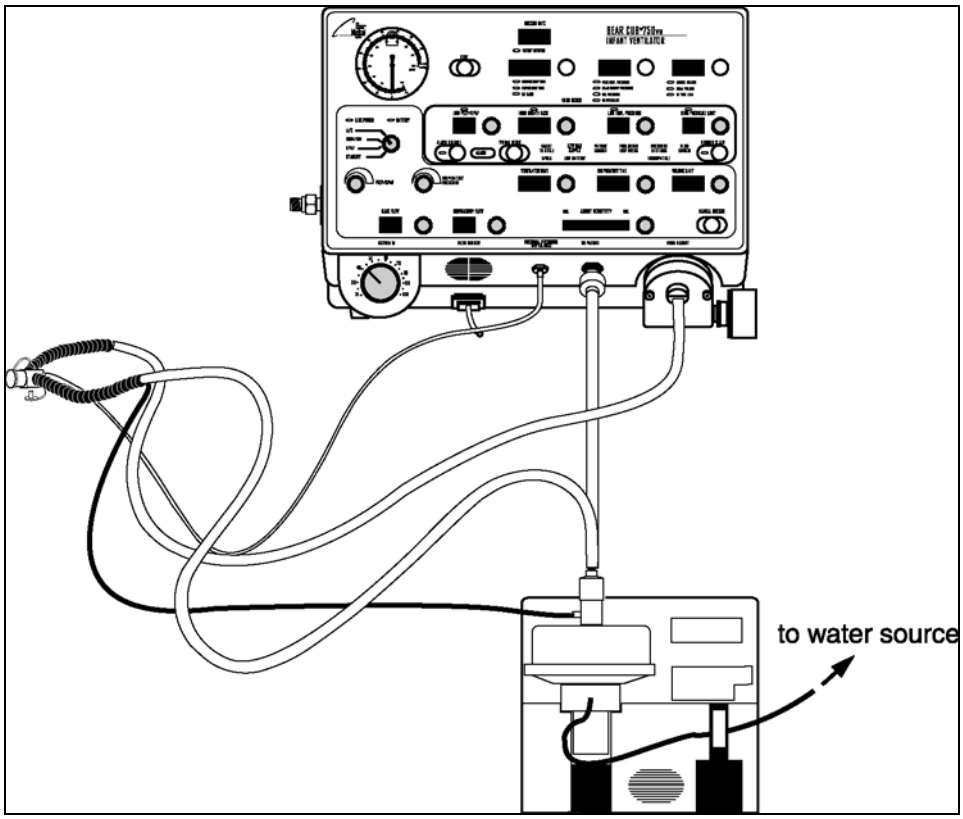


Figure 3-1: Bear Cub 750 US with Patient Circuit

Exterior Inspection and Cleaning

Inspect all cords, connectors, and fittings. Inspect the case for any cracks or other damage.

Exterior Cleaning

1. Before any cleaning of the ventilator, disconnect WALL AC.
2. Clean the exterior of the ventilator with an appropriate bactericidal or germicidal agent. Care should be exercised not to allow any liquid to penetrate the inside of the ventilator.

CAUTION

Do not use Methyl Ethyl Ketone (MEK) or Tricloroethylene, as damage to surfaces will result. Do not allow any liquid to spill or drip into the ventilator.

Plugs and Cables

Plugs and cables may be wiped down with an appropriate bactericidal or germicidal agent.

OVP Checklist

This checklist is for use during the BEAR CUB™ 750vs Operational Verification Procedure.
Serial Number_____ Hour meter reading_____ Today's date_____
Service Location_____Service Organization _____
Address _____Address _____
City/State/Zip_____City/State/Zip_____
Contact _____Contact _____
Phone ( )_____Phone ( )_____

Verification Steps

STEP	PASS	FAIL	STEP	PASS	FAIL
Indicator Verification	☐	☐	O2 Pressure Reading Verification	☐	☐
Breath Rate Verification	☐	☐	Low Gas Supply Verification(Air)	☐	☐
Alarm Silence, Reset Verification	☐	☐	Low Gas Supply Verification (O2)	☐	☐
Exhalation Time, I:E Ratio Verification	☐	☐	Fail to Cycle alarm verification	☐	☐
Low Pressure alarm Verification	☐	☐	FIO2 verification (21%, 60%, 100%)	☐	☐
High Pressure alarm/Limit Verification	☐	☐	Low PEEP/CPAP alarm verification	☐	☐
Pressure LED reset	☐	☐	AC power loss verification	☐	☐
Prolonged Inspiratory alarm verification	☐	☐	Tidal Volume Limit verification	☐	☐
High Rate alarm verification	☐	☐	Flow Sensor alarm verification	☐	☐
Apnea alarm verification	☐	☐	Patient Triggering verification	☐	☐
Incompatible setting alarm verification	☐	☐	Alarm loudness verification	☐	☐
Air Pressure reading verification	☐	☐			

ADD Warning ?????

Signature _____
PROCEDURE COMPLETE

Chapter 4 Calibration (for software releases 2 and 3 only)

Introduction

The information in this section is intended for use by a factory trained service technician. Before opening the console or removing assemblies to perform calibration, a reference should be made to the Instruction Manual and Sections 1, 2, 3, and 7 of this Manual to assure that the ventilator is being properly utilized.

WARNINGS

- The calibration procedures contained in this section must be completed when any part/assembly has been removed and/or replaced. Failure to do so could result in ventilator malfunction and injury or death to the patient.
- After calibration and/or replacement of any assembly(ies), always perform the Operational Verification Procedure (Section 3), then allow a "BURN-IN" period and repeat the Operational Verification Procedure.
- Oxygen vigorously accelerates combustion. DO NOT use any gauges, valves or other equipment that has been exposed to oil or grease contamination to avoid violent ignition.
- Hazardous voltages exist within the ventilator. Always observe appropriate safety precautions when working on the ventilator while the machine is connected to an electrical power source to prevent possible accidental injurious electrical shock.
- When high pressure gas sources are connected to the ventilator, always use extreme caution when attempting to measure internal pressures. Abnormal conditions may exist where measured pressures exceed the burst pressure of the gauge, resulting in possible injury.

NOTE

The Operational Verification Procedure (OVP) is always performed prior to use of this section.

CAUTION

- Before using any test equipment (electronic or pneumatic) for calibration purposes (other than operational verification), the accuracy of the instruments must be certified by a testing laboratory. The laboratory master test instruments must be traceable to the US Bureau of Standards or equivalent. When variances exist between the indicated and actual values, the calibration curves (proved by the testing laboratory) must be used to establish the actual correct values. This certification procedure should be performed at least once every six months. More frequent certification may be required based on usage and environment.

NOTE

If problems are incurred in obtaining the calibration performance, refer to Troubleshooting (Section 7) or contact your dealer or VIASYS Healthcare Service Facility.

Pressure Transducers and Flow Control Valve Calibration

Turn OFF the ventilator and disconnect tubing to the Pressure Transducers on the Control PCB. Press and hold the diagnostic switch on the Control PCB while turning the ventilator ON to enter Transducers and Flow Calibration routines. Throughout calibration, the TEST key is for advancing the calibration number; VISUAL RESET is for backing to previous calibration, and the MANUAL BREATH key is for recording calibration data. The calibration number and message are displayed in the Breath Rate and Monitored Time/I:E Ratio windows respectively. Data (when applicable) is displayed in the Monitored Pressure window. Refer to the following (See table 4-1) to calibrate the transducers on the Control PCB:

Table 4-1: Control PCB Transducer Calibration

Transducer	Calibration Number	Message	Input Static Pressure
Machine (port B)	d00	nP00	0 cmH2O
	d01	nP40	40 ± 0.2 cmH2O
Differential (port B)	d02	dP00	0 cmH2O
	d03	dP40	40 ± 0.2 cmH2O
Proximal (port B)	d04	pP00	0 cmH2O
	d05	pP40	40 ± 0.2 cmH2O
O2 (A2)	d06	0P00	0 PSIG
	d07	0P40	40 ± 0.2 PSIG
AIR (A1)	d08	AP00	0 PSIG
	d09	AP40	40 ± 0.2 PSIG

NOTE

The 40 cm/psi settings were 70 cm/psi prior to monitor firmware 511-02803-00. When calibrating the pressure transducers, both pressure points (i.e. 0 and 40 cm/psi) must be read and the 0 cm/psi reading must be obtained first.

1. Check the accuracy of the five pressure transducers per table 4.2. The window shows the pressure readings monitor pressure.
2. Press the TEST key to advance the calibration number to the Display Set Altitude Test, then press the MANUAL BREATH key until the number in the PRESSURE window indicates the altitude at which the Flow Control valve calibration is to be performed (expressed in units of 100 ft). Then advance to the next test number and power down.
3. Re-connect tubing to the transducers on the Control PCB; apply Air and O2 (approximately 50 psi) to UUT. Use an RT-200 to measure flow at the TO

PATIENT port. To calibrate the Flow Control Valve, press the TEST key to advance the calibration number; then set flow as specified and press the MANUAL BREATH key to record data. Calibrate Base Flow, then Calibrate Inspiratory Flow.

Table 4-2: Calibration

Transducer	Calibration Number	Message	Input Static Pressure
Differential (port B)	d10	0 ± 1	0 cmH2O
	d10	50 ± 1	50 ± 0.5 cmH2O
Machine (port B)	d11	0 ± 1	0 cmH2O
	d11	50 ± 1	50 ± 0.5 cmH2O
Proximal (port B)	d12	0 ± 1	0 cmH2O
	d12	50 ± 1	50 ± 0.5 cmH2O
AIR (A1)	d13	50 ± 2	50 ± 0.2 PSI
O2 (A2)	d14	50 ± 2	50 ± 0.2 PSI

NOTE

The pressure display occasionally flickering 1 digit beyond the tolerance is acceptable.

Table 4-3: Diagnostic Function

NUMBER	FUNCTION
00	Calibrate pmach @ 0 cmH_2O
01	Calibrate pmach @ 40 cmH_2O
02	Calibrate pdelta @ 0 cmH_2O
03	Calibrate pdelta @ 40 cmH_2O
04	Calibrate proxp @ 0 cmH_2O
05	Calibrate proxp @ 40 cmH_2O
06	Calibrate O2p @ 0 cmH_2O
07	Calibrate O2p @ 40 cmH_2O
08	Calibrate airp @ 0 cmH_2O
09	Calibrate airp @ 40 cmH_2O
10	Display pdelta
11	Display pmach
12	Display proxp
13	Display airp
14	Display O_2p
15	Display/Set Altitude
16	Calibrate Base Flow @ 1 L/min*
17	Calibrate Base Flow @ 2 L/min*
18	Calibrate Base Flow @ 5 L/min*
19	Calibrate Base Flow @ 15 L/min*
20	Calibrate Base Flow @ 25 L/min*
21	Calibrate Base Flow @ 30 L/min*
22	Calibrate Insp Flow @ 1 L/min*
23	Calibrate Insp Flow @ 2 L/min*
24	Calibrate Insp Flow @ 5 L/min*
25	Calibrate Insp Flow @ 15 L/min*
26	Calibrate Insp Flow @ 25 L/min*
27	Calibrate Insp Flow @ 30 L/min*

**±0.5 L/min*

NOTE

Diagnostic numbers can only be accessed by depressing the diagnostic switch on the Control PCB while turning the Ventilator ON.

Table 4-4: Inspiratory Flow Calibration

Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
Sea Level	**500 feet**	**1000 feet**	**1500 feet**	**2000 feet**	**2500 feet**	**3000 feet**	**3500 feet**	**4000 feet**
2.00± .02	2.02± .02	2.04± .02	2.05± .02	2.08± .02	2.10± .02	2.12± .02	2.14± .02	2.16± .02
5.00± .03	5.05± .03	5.10± .03	5.14± .03	5.19± .03	5.24± .03	5.29± .03	5.33± .03	5.38± .03
15.00± .1	15.1± .1	15.3± .1	15.4± .1	15.5± .1	15.7± .1	15.8± .1	15.9± .1	16.1± .1
25.00± .2	25.2± .2	25.4± .2	25.6± .2	25.8± .2	26.0± .2	26.2± .2	26.4± .2	26.6± .2
30.00± .2	30.2± .2	30.5± .2	30.7± .2	30.9± .2	31.2± .2	31.4± .2	31.6± .2	31.9± .2

Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow	Flow
Sea Level	**4500 feet**	**5000 feet**	**5500 feet**	**6000 feet**	**6500 feet**	**7000 feet**	**7500 feet**	**8000 feet**
2.00± .02	2.18± .02	2.20± .02	2.23± .02	2.26± .02	2.29± .02	2.31± .02	2.34± .02	2.37± .02
5.00± .03	5.44± .03	5.5± .1	5.6± .1	5.6± .1	5.7± .1	5.8± .1	5.8± .1	5.9± .1
15.00± .1	16.2± .1	16.4± .1	16.6± .1	16.7± .1	16.9± .1	17.1± .1	17.3± .1	17.5± .1
25.00± .2	26.9± .2	27.1± .2	27.4± .2	27.7± .2	28.0± .2	28.3± .2	28.6± .2	28.9± .2
30.00± .2	32.1± .2	32.4± .2	32.7± .2	33.0± .2	33.4± .2	33.8± .2	34.1± .2	34.5± .2

Air and O_2 Regulator Balance

Objective

To define the calibration requirements for balancing the Air and O_2 Regulators.

Equipment

Pressure gauge, 0 - 30 psig, ± 1/4% F.S.

Differential pressure gauge, 2 - 0 - 2 cmH_2O, ± 5% F.S. Flow meter, 0 - 10 L/min, ± 3% F.S.

Requirements

Regulator and Bleed Valve Adjustment:

Set up per Standard Test Settings except set MODE to STANDBY

Set O_2 Blender as noted (Table 4-5)

Set O_2 supply pressure to 50 psi

Patient circuit may be omitted

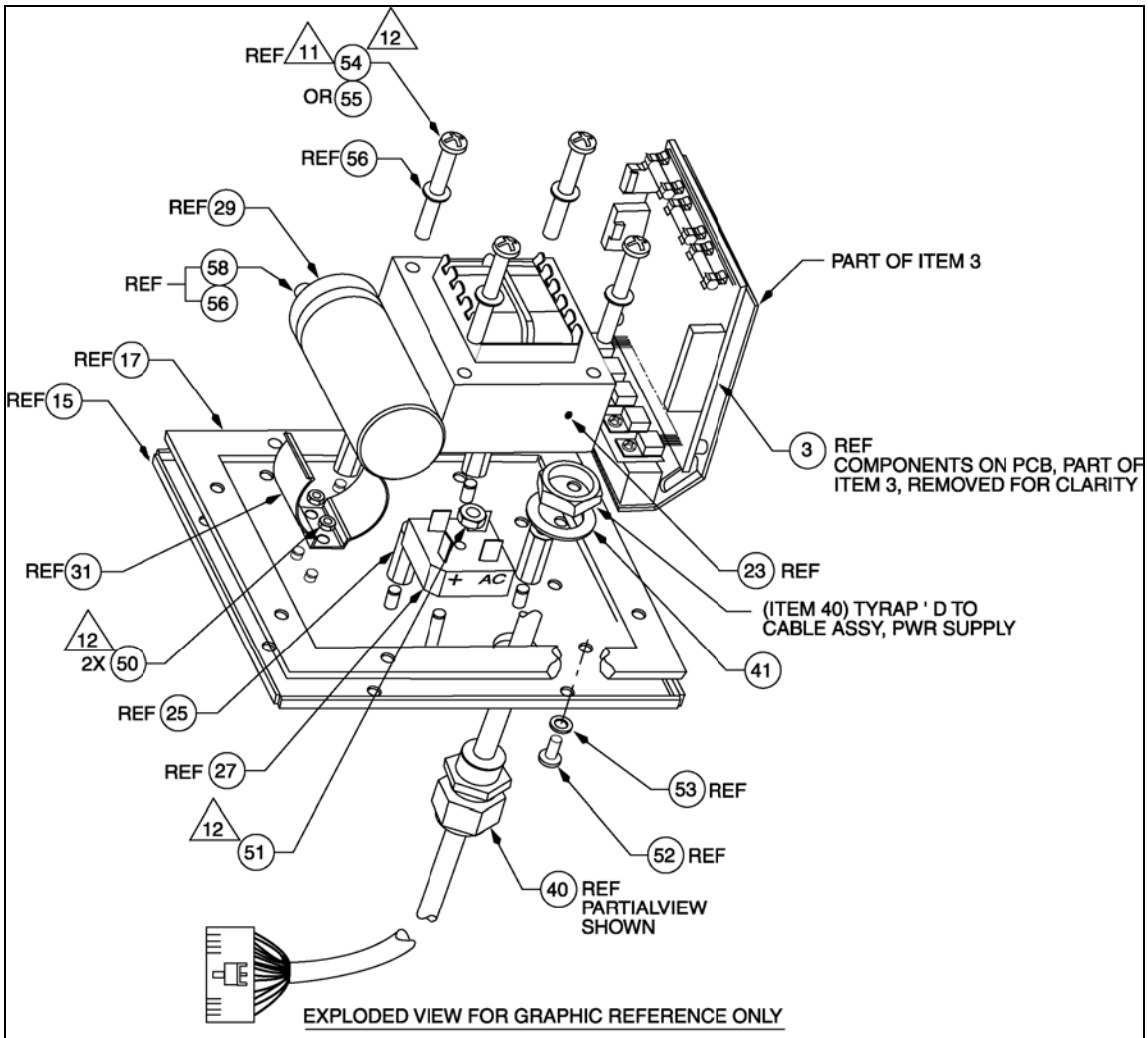
Table 4-5: Regulator Balance

Component	O_2 Blender Setting	Requirement
Air Regulator	100%	17.0 ± 1 psig
O_2 Regulator	60%	Adjust O_2 regulator to obtain a pressure balance with the air regulator within 2 cmH_2O.
Bleed Valve	60%	With Base Flow Control Valve set to minimum, Bleed Valve exhaust shall equal 3.5 - 5.5 L/min.
Air Regulator	60%	Increase Base Flow rate to maximum.
O_2 Regulator		Regulators shall remain balanced within 2 cmH_2O.
Bleed Valve		Bleed Valve Flow drops to less than .25 L/min.

Table 4-6: Standard Test Settings

CONTROLS	
Mode	Assist/Control
PEEP/CPAP Pressure	0 cmH2O
Inspiratory Pressure (PIP)	20 cmH2O
Ventilator Rate	30 BPM
Inspiratory Time	1.00 second
Volume Limit	300 mL
Base Flow	5 L/min
Inspiratory Flow	15 L/min
Assist Sensitivity	Mid Range
ALARMS	
Low PEEP/CPAP Alarm	-5 cmH2O
High Breath Rate Alarm	255 BPM
Low Inspiratory Pressure Alarm	5 cmH2O
High Pressure Limit Alarm	75 cmH2O
FRONT OF VENTILATOR	
Humidifier	VH-820 chamber, no water
Patient Circuit	Standard Allied Infant Circuit
Patient Resistance	Rp 20
Patient Compliance	C3
Endotracheal Tube	None
Auxiliary Pressure Relief	Fully closed (CW)
REAR OF VENTILATOR	
Alarm Loudness Control	Minimum
RS-232 Interface	Open
Analog Output	Open
Remote Nurses call	Open
APNEA Alarm	30 seconds
Display Power Outlet	Open
AC Line Voltage	120 VAC
O2 Supply	>35 PSI
Air Supply	>35 PSI

Chapter 5 Schematics and Assemblies



12 TORQUE TABLE

ITEM NO.	QTY	THREAD (REF)	IN-LB TORQUE
25	4	10 - 32	15 TO 18
50	2	6 - 32	1/4 TO 1/2 TURN PAST INITIAL SEAT
51	1	10 - 32	15 TO 18
52	3	6 - 32	1/4 TO 1/2 TURN PAST INITIAL SEAT
54	4	10 - 32	15 TO 18
55	2	10 - 32	15 TO 18

11 DEPENDING UPON THICKNESS OF TRANSFORMER, ITEM 23, USE EITHER ITEM 54 OR ITEM 55 TO ENSURE THREAD ENGAGEMENT IS .30 MINIMUM.

Figure 5-1:

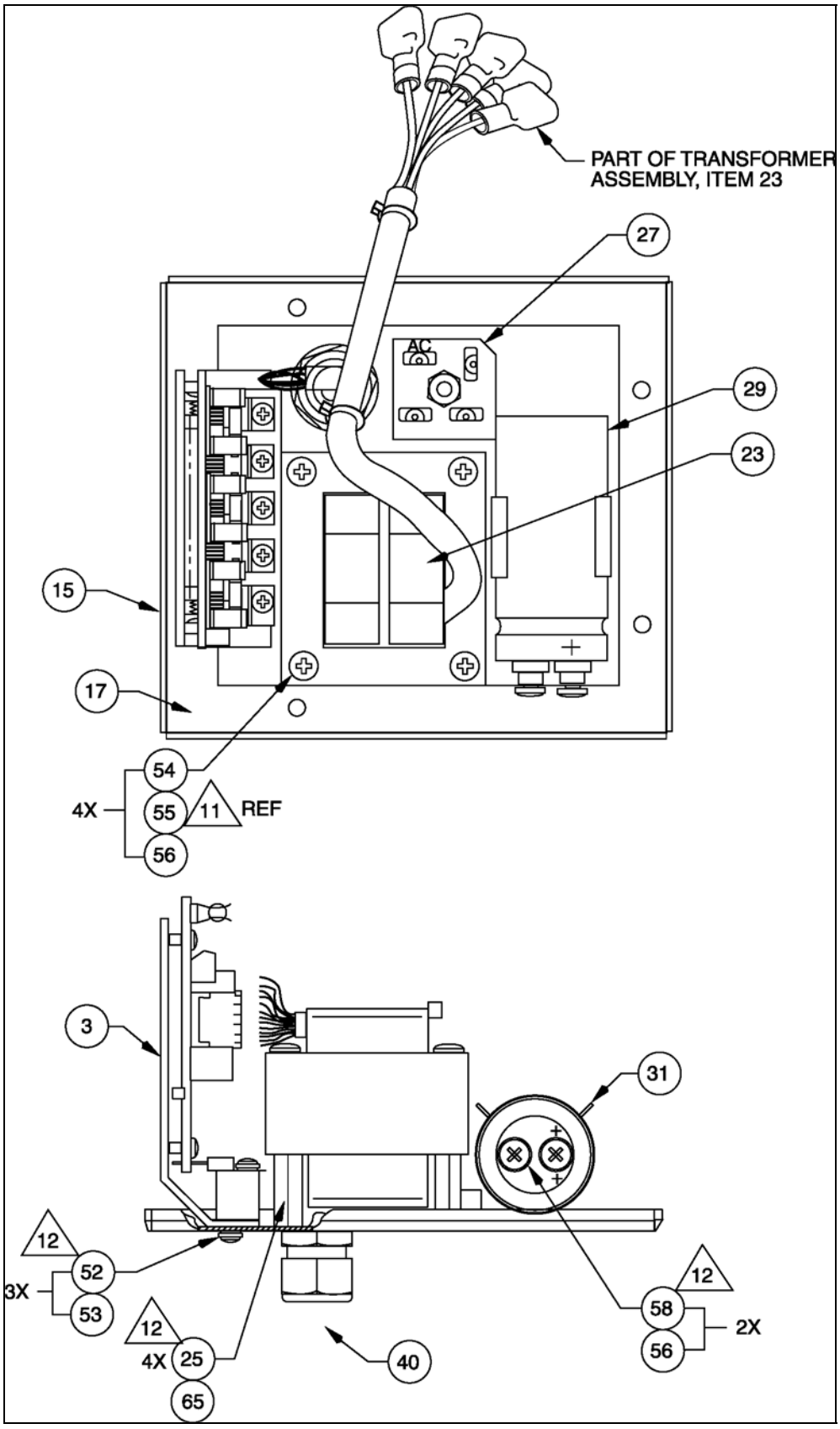

PART OF TRANSFORMER ASSEMBLY, ITEM 23
27
AC
29
23
15
17
54
4X
55
11
REF
56
3
31
12
52
3X
53
12
4X
25
65
40
12
58
56
2X

Figure 5-2:

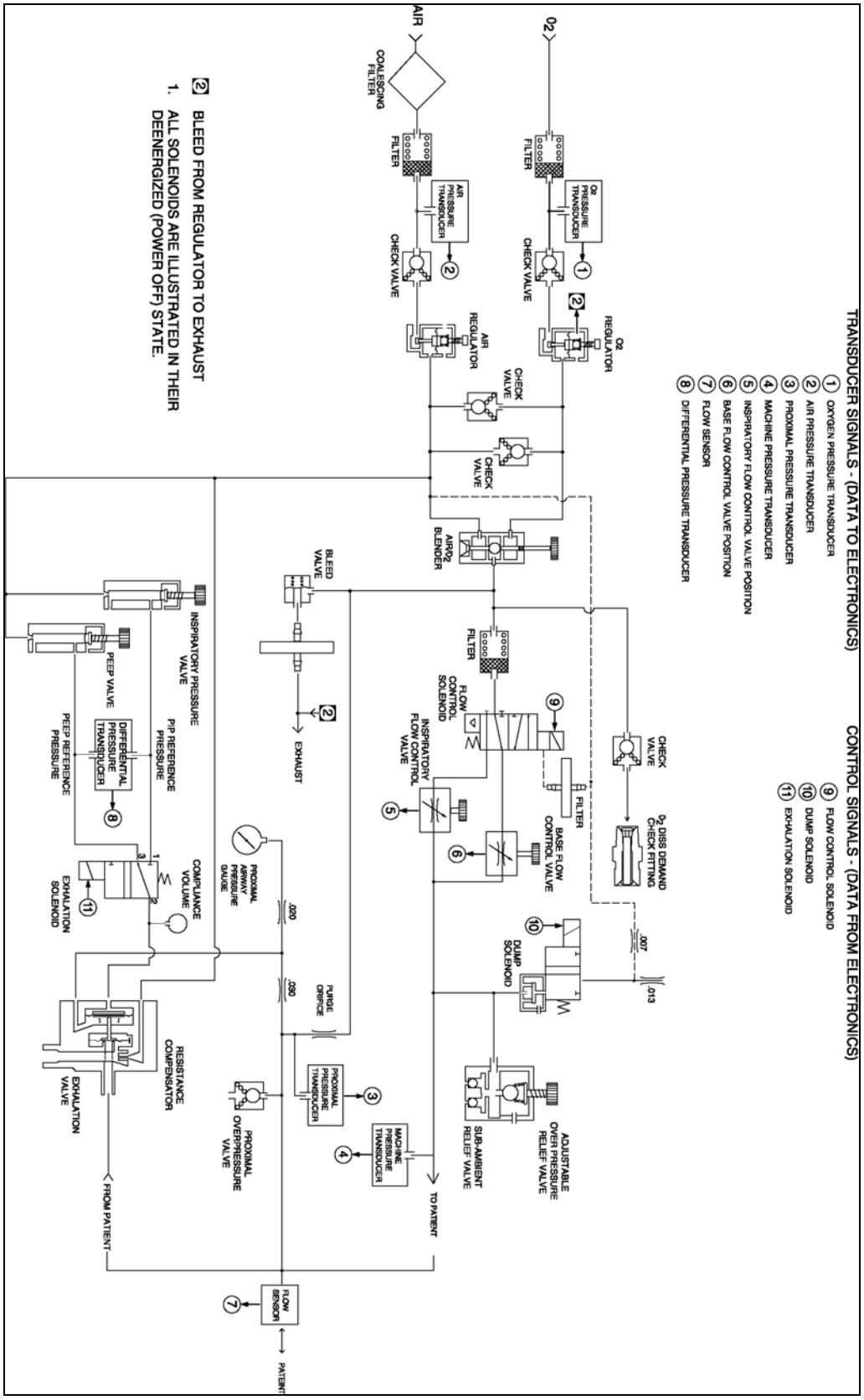

TRANSDUCER SIGNALS - (DATA TO ELECTRONICS)
1 OXYGEN PRESSURE TRANSDUCER
2 AIR PRESSURE TRANSDUCER
3 PROXIMAL PRESSURE TRANSDUCER
4 MACHINE PRESSURE TRANSDUCER
5 INSPIRATORY FLOW CONTROL VALVE POSITION
6 BASE FLOW CONTROL VALVE POSITION
7 FLOW SENSOR
8 DIFFERENTIAL PRESSURE TRANSDUCER
CONTROL SIGNALS - (DATA FROM ELECTRONICS)
9 FLOW CONTROL SOLENOID
10 DUMP SOLENOID
11 EXHALATION SOLENOID
2 BLEED FROM REGULATOR TO EXHAUST
1. ALL SOLENOIDS ARE ILLUSTRATED IN THEIR DEENERGIZED (POWER OFF) STATE.
AIR
O2
COALESCING FILTER
FILTER
AIR PRESSURE TRANSDUCER
O2 PRESSURE TRANSDUCER
CHECK VALVE
AIR REGULATOR
O2 REGULATOR
AIR/O2 BLENDER
BLEED VALVE
EXHAUST
INSPIRATORY PRESSURE VALVE
PEEP VALVE
PEEP REFERENCE PRESSURE
PIP REFERENCE PRESSURE
DIFFERENTIAL PRESSURE TRANSDUCER
EXHALATION SOLENOID
COMPLIANCE VOLUME
PROXIMAL AIRWAY PRESSURE GAUGE
PURGE ORIFICE
RESISTANCE COMPENSATOR
EXHALATION VALVE
PROXIMAL OVERPRESSURE VALVE
PROXIMAL PRESSURE TRANSDUCER
MACHINE PRESSURE TRANSDUCER
FLOW CONTROL SOLENOID
INSPIRATORY FLOW CONTROL VALVE
BASE FLOW CONTROL VALVE
FILTER
CHECK VALVE
O2 DISS DEMAND CHECK FITTING
DUMP SOLENOID
SUB-AMBIENT RELIEF VALVE
ADJUSTABLE OVER PRESSURE RELIEF VALVE
.020
.030
.007
.013
TO PATIENT
FROM PATIENT
FLOW SENSOR
PATIENT

Figure 5-3:

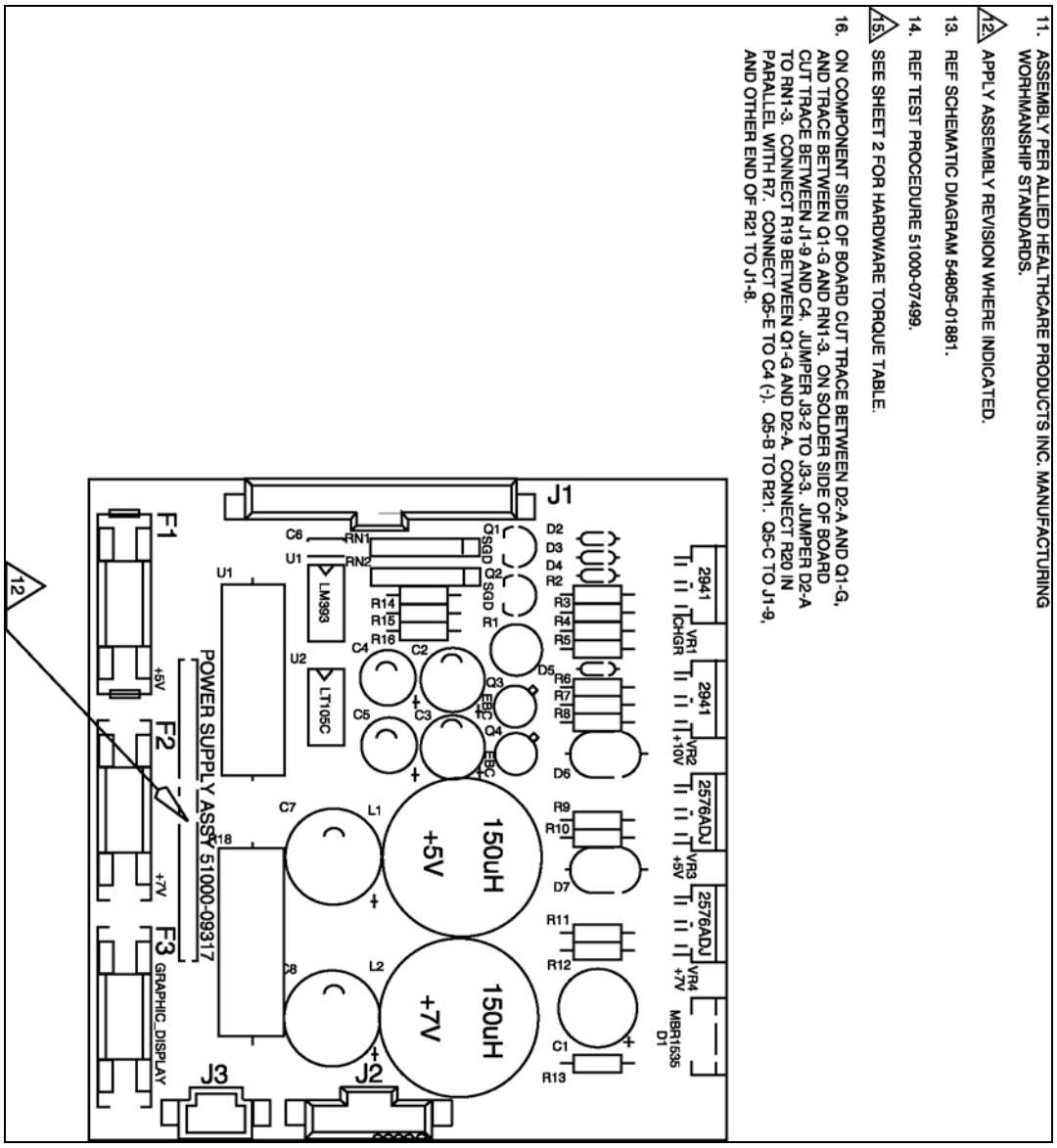

11. ASSEMBLY PER ALLIED HEALTHCARE PRODUCTS INC. MANUFACTURING WORKMANSHIP STANDARDS.
12 APPLY ASSEMBLY REVISION WHERE INDICATED.
13. REF SCHEMATIC DIAGRAM 54805-01881.
14. REF TEST PROCEDURE 51000-07499.
15 SEE SHEET 2 FOR HARDWARE TORQUE TABLE.
16. ON COMPONENT SIDE OF BOARD CUT TRACE BETWEEN D2-A AND Q1-G, AND TRACE BETWEEN Q1-G AND RN1-3. ON SOLDER SIDE OF BOARD CUT TRACE BETWEEN J1-9 AND C4. JUMPER J3-2 TO J3-3. JUMPER D2-A TO RN1-3. CONNECT R19 BETWEEN Q1-G AND D2-A. CONNECT R20 IN PARALLEL WITH R7. CONNECT Q5-E TO C4 (-). Q5-B TO R21. Q5-C TO J1-9, AND OTHER END OF R21 TO J1-8.
12
J1
F1
F2
F3
+5V
+7V
GRAPHIC_DISPLAY
POWER SUPPLY ASSY 51000-09317
J3
J2
U1
U2
LM393
LT105C
RN1
RN2
C6
C7
C8
C18
L1
L2
150uH
150uH
+5V
+7V
Q1
Q2
Q3
Q4
SGD
EBC
D2
D3
D4
D5
D6
D7
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
C1
C2
C3
C4
C5
2941
VR1
CHGR
2941
VR2
+10V
2576ADJ
VR3
+5V
2576ADJ
VR4
+7V
MBR1635
D1

Figure 5-4:

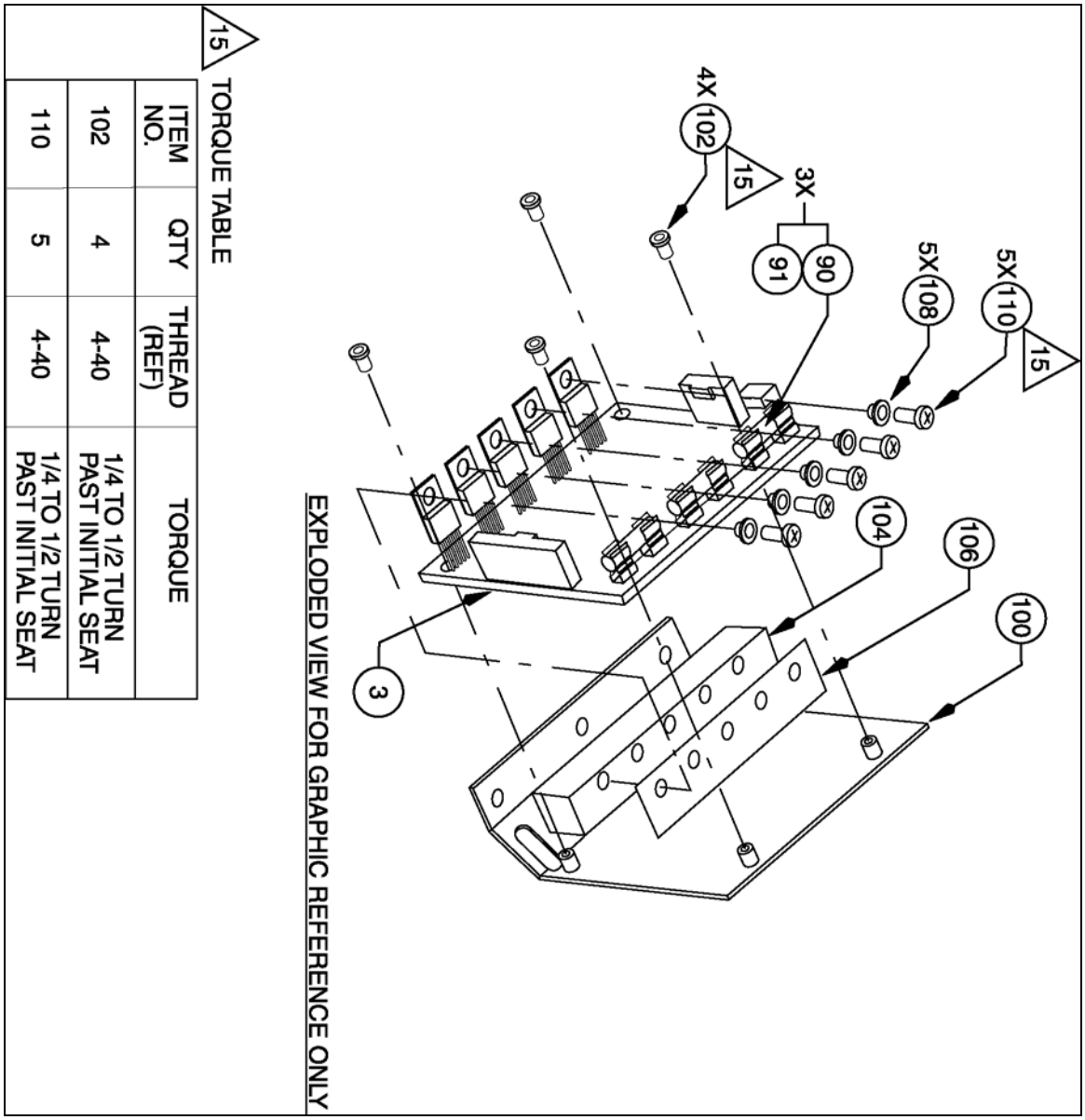

15 TORQUE TABLE
ITEM NO. | QTY | THREAD (REF) | TORQUE
102 | 4 | 4-40 | 1/4 TO 1/2 TURN PAST INITIAL SEAT
110 | 5 | 4-40 | 1/4 TO 1/2 TURN PAST INITIAL SEAT
EXPLODED VIEW FOR GRAPHIC REFERENCE ONLY
4X 102
15
3X
91
90
5X 108
5X 110
15
104
106
100
3

Figure 5-5:

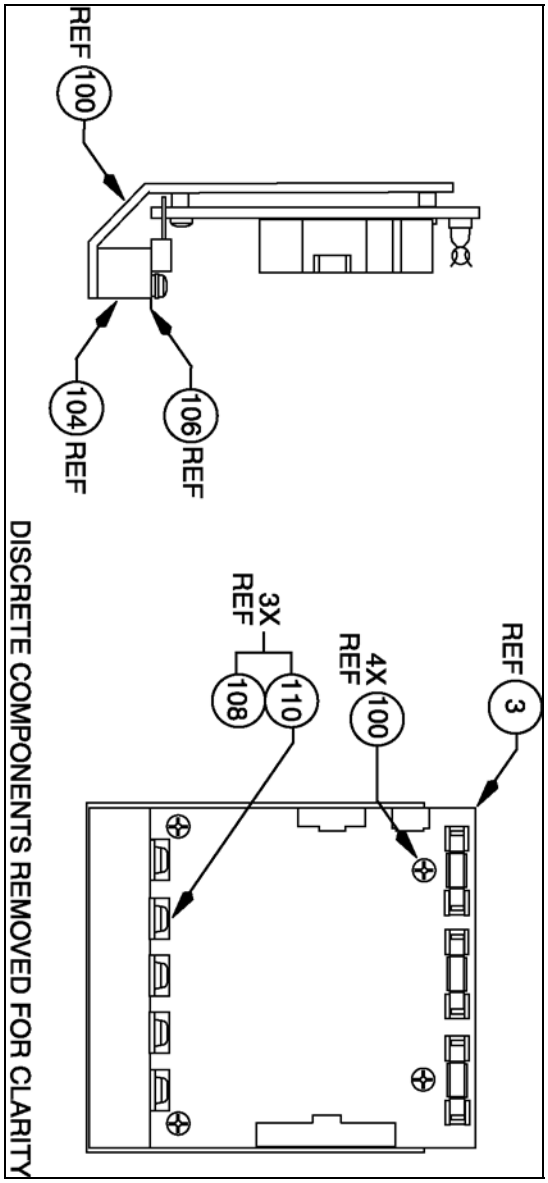

REF 100
104 REF
106 REF
3X REF
108
110
4X REF 100
REF 3
DISCRETE COMPONENTS REMOVED FOR CLARITY

Figure 5-6:

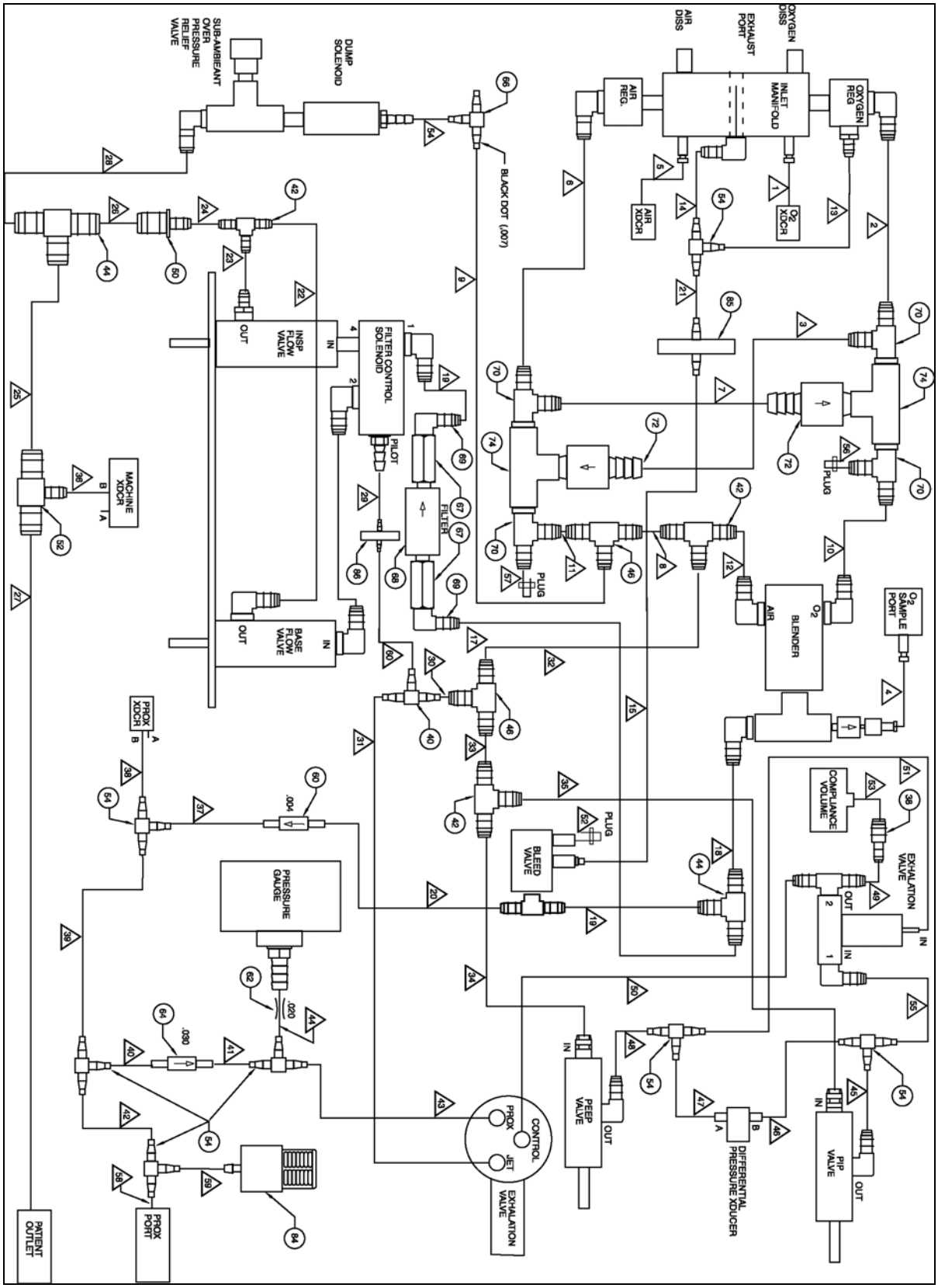

SUB-AMBIENT OVER PRESSURE RELIEF VALVE
DUMP SOLENOID
AIR DISS
EXHAUST PORT
OXYGEN DISS
AIR REG.
INLET MANIFOLD
OXYGEN REG
BLACK DOT (.007)
AIR XDCR
O2 XDCR
INSP FLOW VALVE
FILTER CONTROL SOLENOID
PILOT
FILTER
BASE FLOW VALVE
MACHINE XDCR
PLUG
O2 SAMPLE PORT
AIR
O2
BLENDER
PROX XDCR
.004
COMPLIANCE VOLUME
EXHALATION VALVE
BLEED VALVE
PRESSURE GAUGE
.020
.030
PEEP VALVE
DIFFERENTIAL PRESSURE XDUCER
PIP VALVE
CONTROL
PROX
JET
EXHALATION VALVE
PATIENT OUTLET
PROX PORT

Figure 5-7:

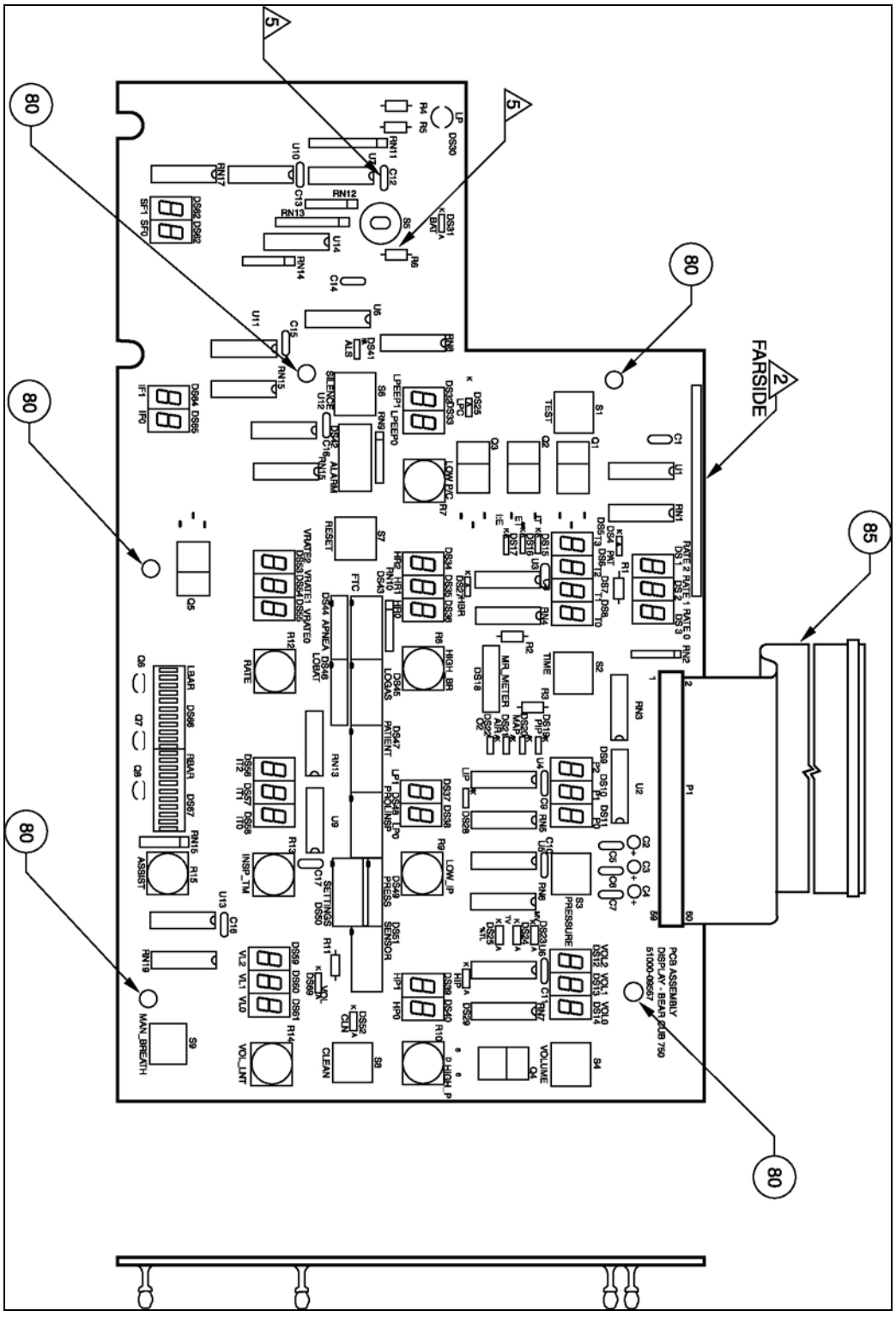


Figure 5-8:

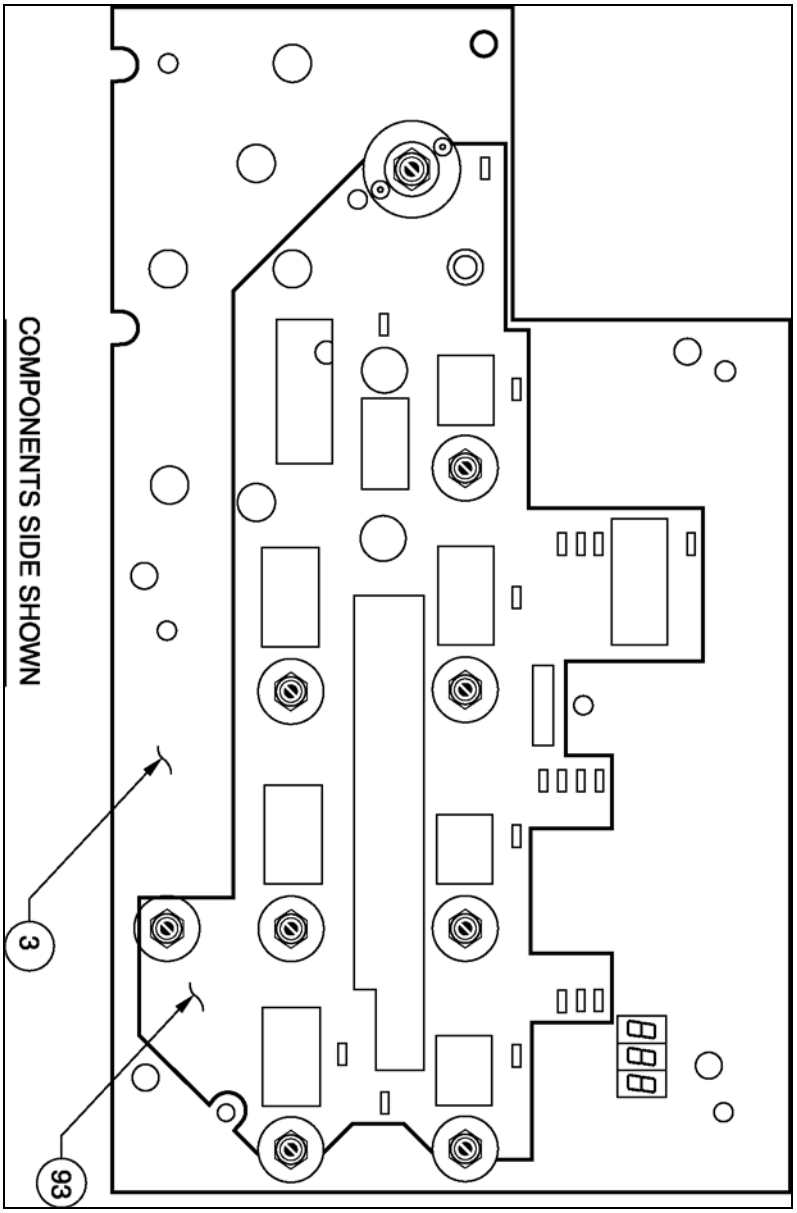


Figure 5-9:

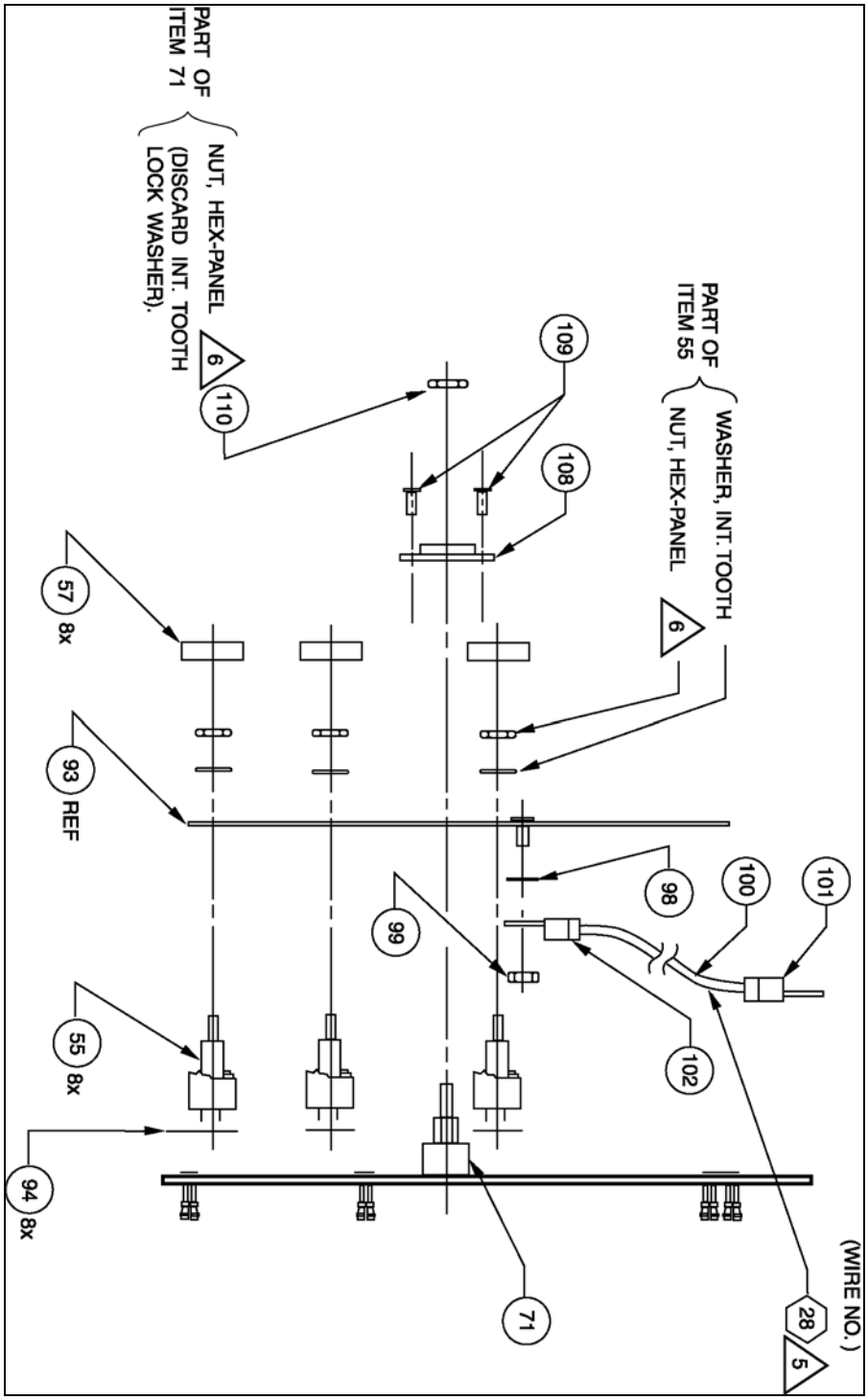

PART OF ITEM 71
NUT, HEX-PANEL
(DISCARD INT. TOOTH LOCK WASHER).
6
110
109
108
PART OF ITEM 55
WASHER, INT. TOOTH
NUT, HEX-PANEL
6
57 8x
93 REF
98
100
101
99
55 8x
102
94 8x
71
28
5
(WIRE NO.)

Figure 5-10:

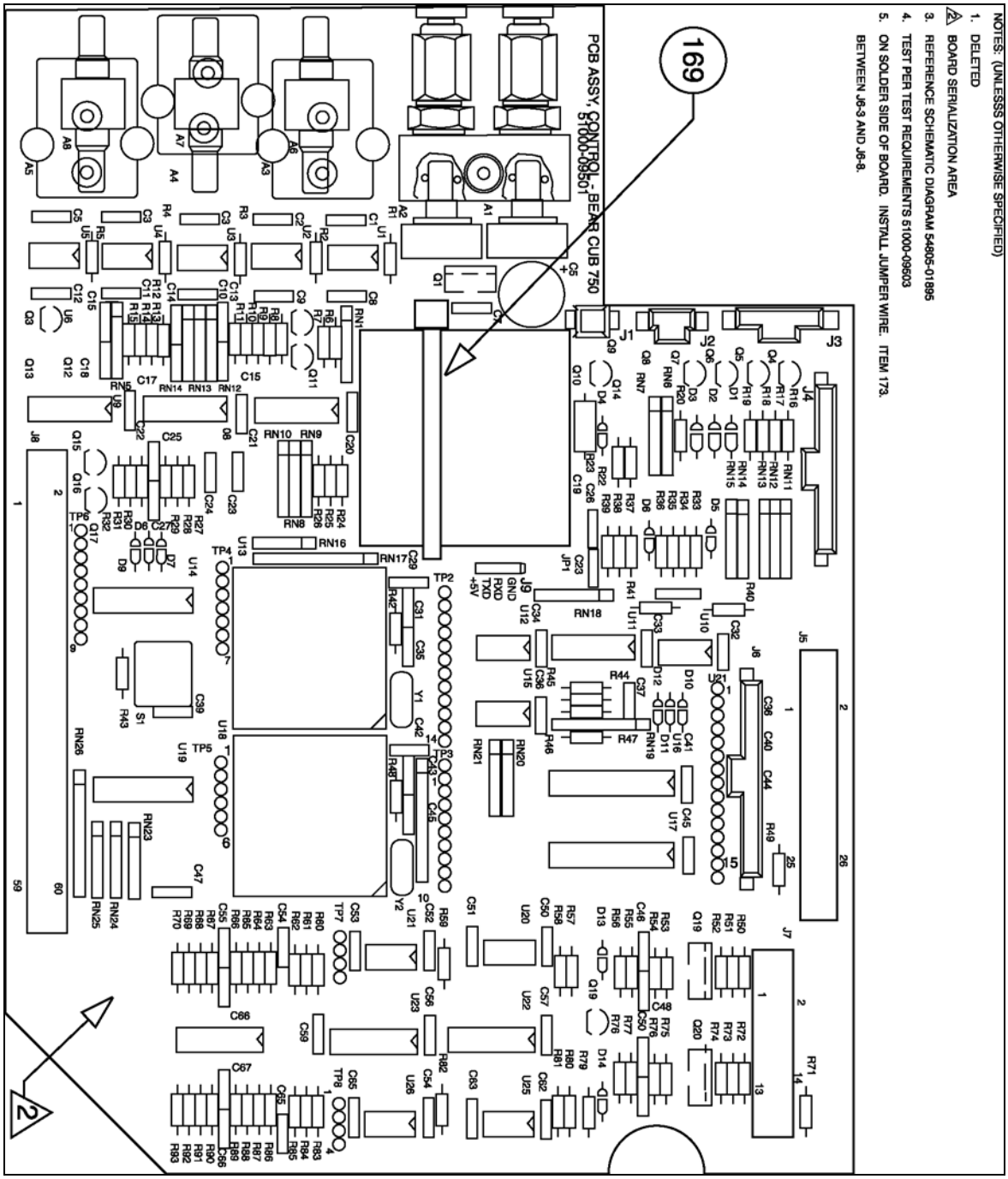

NOTES: (UNLESSS OTHERWISE SPECIFIED)
1. DELETED
2. BOARD SERIALIZATION AREA
3. REFERENCE SCHEMATIC DIAGRAM 54805-01895
4. TEST PER TEST REQUIREMENTS 51000-09503
5. ON SOLDER SIDE OF BOARD. INSTALL JUMPER WIRE. ITEM 173. BETWEEN J6-3 AND J6-8.
PCB ASSY, CONTROL - BEAR CUB 750 51000-09501
169
2

Figure 5-11:

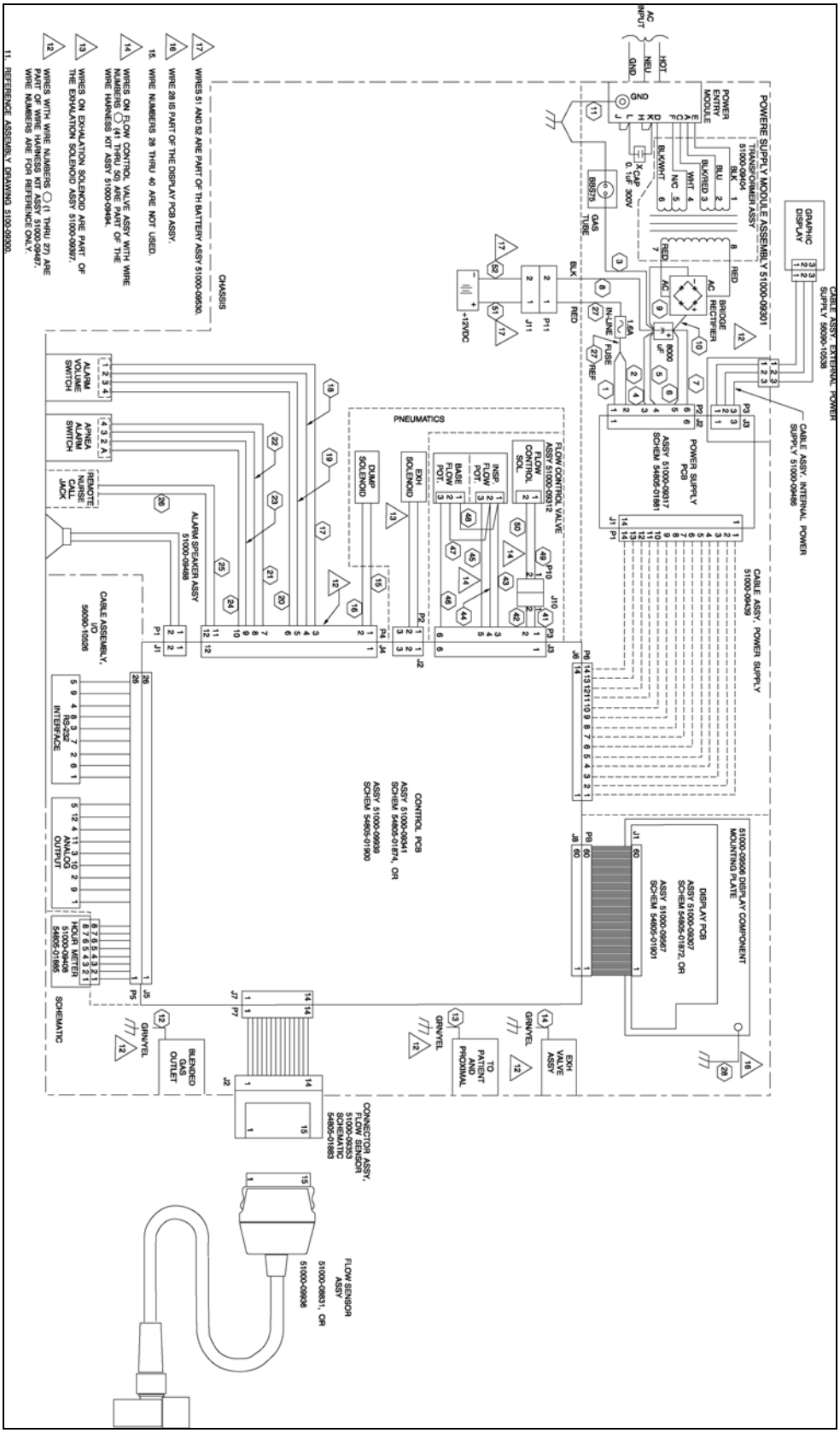


Figure 5-12:

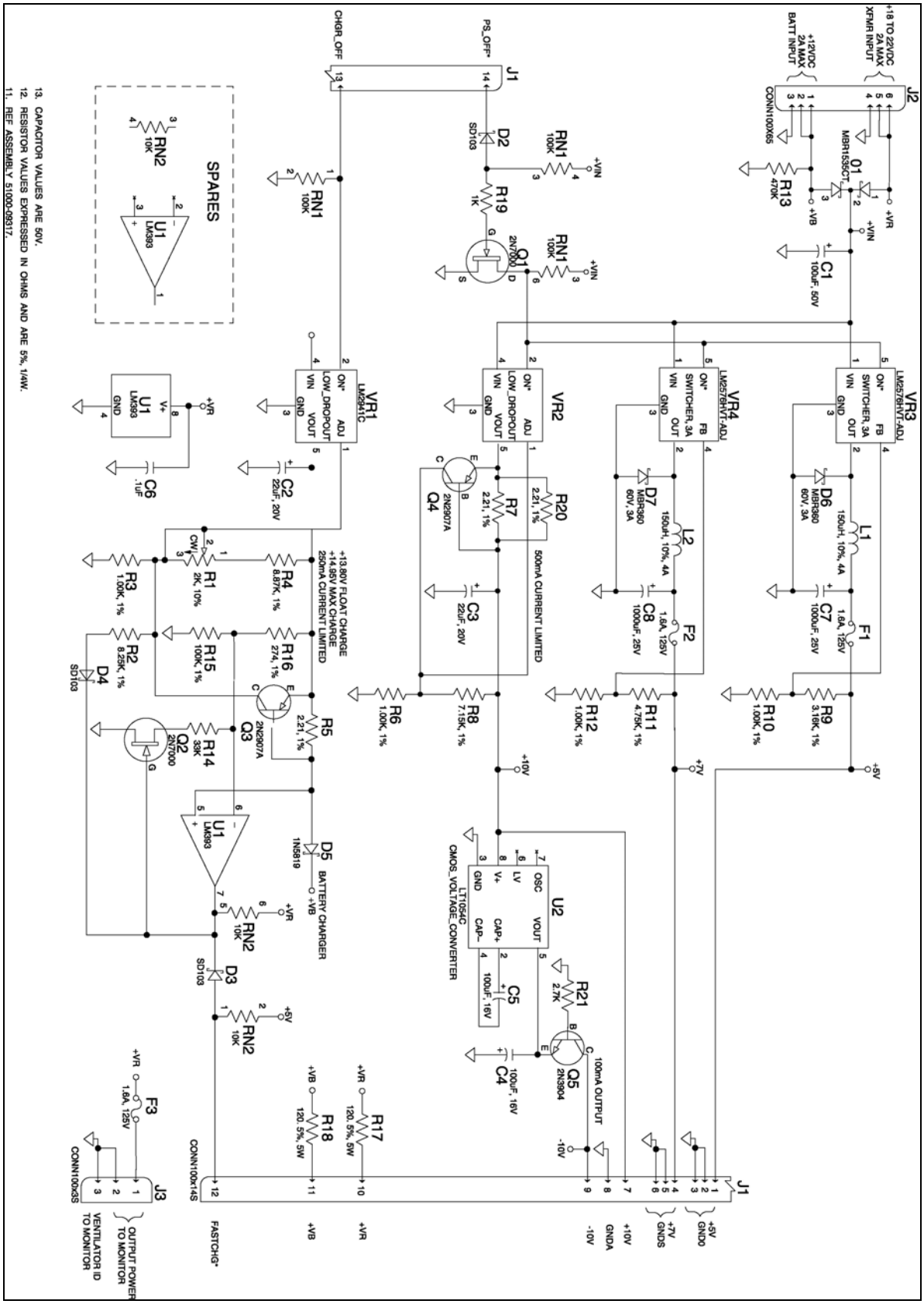

+18 TO 22VDC 2A MAX XFMR INPUT
+12VDC 2A MAX BATT INPUT
CONN100X65
MBR1535CT
R13 470K
C1 100uF, 50V
VR3 LM2576HVT-ADJ
SWITCHER, 3A
D6 MBR360 60V, 3A
L1 150uH, 10%, 4A
C7 1000uF, 25V
F1 1.6A, 125V
R9 3.16K, 1%
R10 1.00K, 1%
+5V
VR4 LM2576HVT-ADJ
D7 MBR360 60V, 3A
L2 150uH, 10%, 4A
C8 1000uF, 25V
F2 1.6A, 125V
R11 4.75K, 1%
R12 1.00K, 1%
+7V
VR2
LOW_DROPOUT
R20 2.21, 1%
R7 2.21, 1%
Q4 2N2907A
C3 22uF, 20V
500mA CURRENT LIMITED
R6 1.00K, 1%
R8 7.15K, 1%
+10V
VR1 LM2941C
C2 22uF, 20V
C6 .1uF
U1 LM393
SPARES
RN2 10K
U1 LM393
J1
CHGR_OFF
PS_OFF*
D2 SD103
RN1 100K
R19 1K
Q1 2N7000
+VIN
+VB
+VR
R1 2K, 10%
R3 1.00K, 1%
R4 8.87K, 1%
R2 8.25K, 1%
R15 100K, 1%
R16 274, 1%
D4 SD103
Q3 2N2907A
R5 2.21, 1%
+13.80V FLOAT CHARGE
+14.95V MAX CHARGE
250mA CURRENT LIMITED
Q2 2N7000
R14 33K
U1 LM393
D5 1N5819
BATTERY CHARGER
RN2 10K
D3 SD103
U2 LT1054C
GMOS_VOLTAGE_CONVERTER
C5 100uF, 16V
C4 100uF, 16V
R21 2.7K
Q5 2N3904
100mA OUTPUT
-10V
R17 120, 5%, 5W
R18 120, 5%, 5W
F3 1.6A, 125V
J3
CONN100X3S
OUTPUT POWER TO MONITOR
VENTILATOR ID TO MONITOR
CONN100X14S
FASTCHG*
+10V GNDA
+7V GNDS
+5V GNDo
13. CAPACITOR VALUES ARE 50V.
12. RESISTOR VALUES EXPRESSED IN OHMS AND ARE 5%, 1/4W.
11. REF ASSEMBLY 51000-09317.

Figure 5-13:

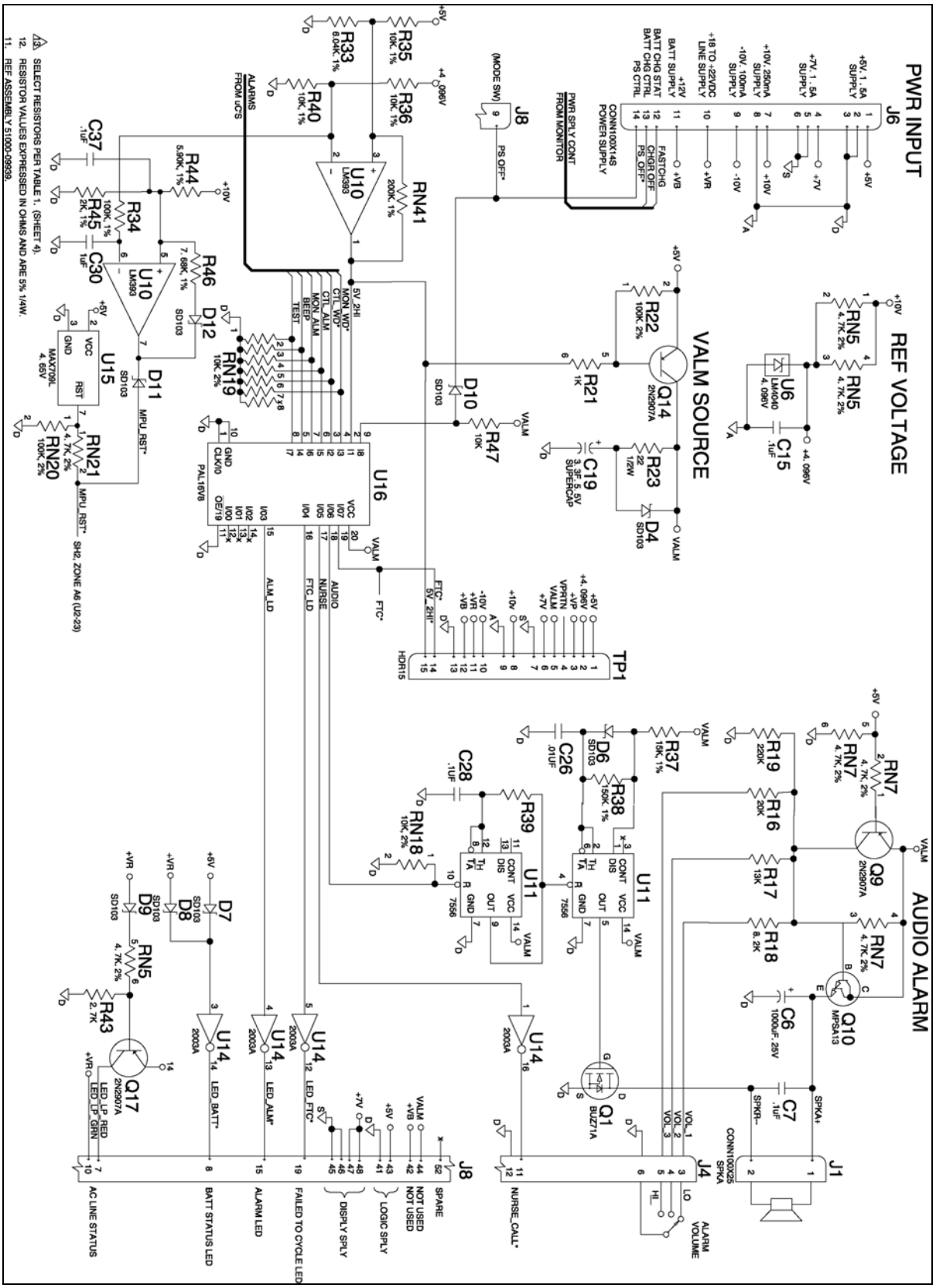

PWR INPUT
REF VOLTAGE
VALM SOURCE
AUDIO ALARM
SELECT RESISTORS PER TABLE 1. (SHEET 4).
RESISTOR VALUES EXPRESSED IN OHMS AND ARE 5% 1/4W.
REF ASSEMBLY 51000-09939.
ALARMS FROM uC'S
PWR SPLY CONT FROM MONITOR
SH2, ZONE A6 (U2-23)
AC LINE STATUS
BATT STATUS LED
ALARM LED
FAILED TO CYCLE LED
DISPLY SPLY
LOGIC SPLY
NOT USED
NOT USED
SPARE
NURSE_CALL*
ALARM VOLUME

Figure 5-14:

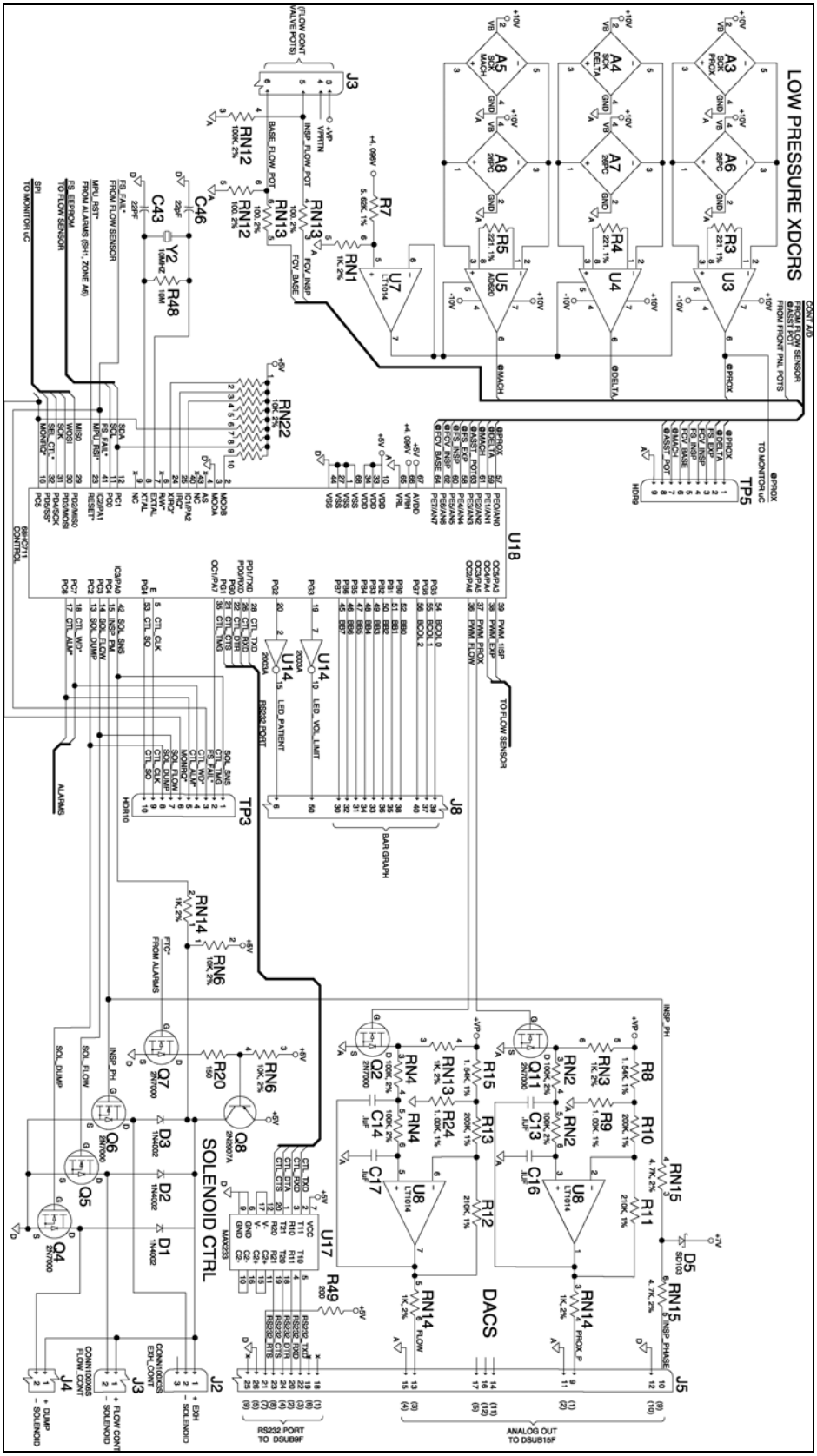

LOW PRESSURE XDCRS
SOLENOID CTRL
DACS
U18
U14
U7
U8
U17
U4
U5
U3
TP5
TP3
J8
J2
J3
J4
J5
Y2
10MHz
MAX3233
ANALOG OUT TO DSUB15F
RS232 PORT TO DSUB9F
TO FLOW SENSOR
TO MONITOR uC
ALARMS
BAR GRAPH

Figure 5-15:

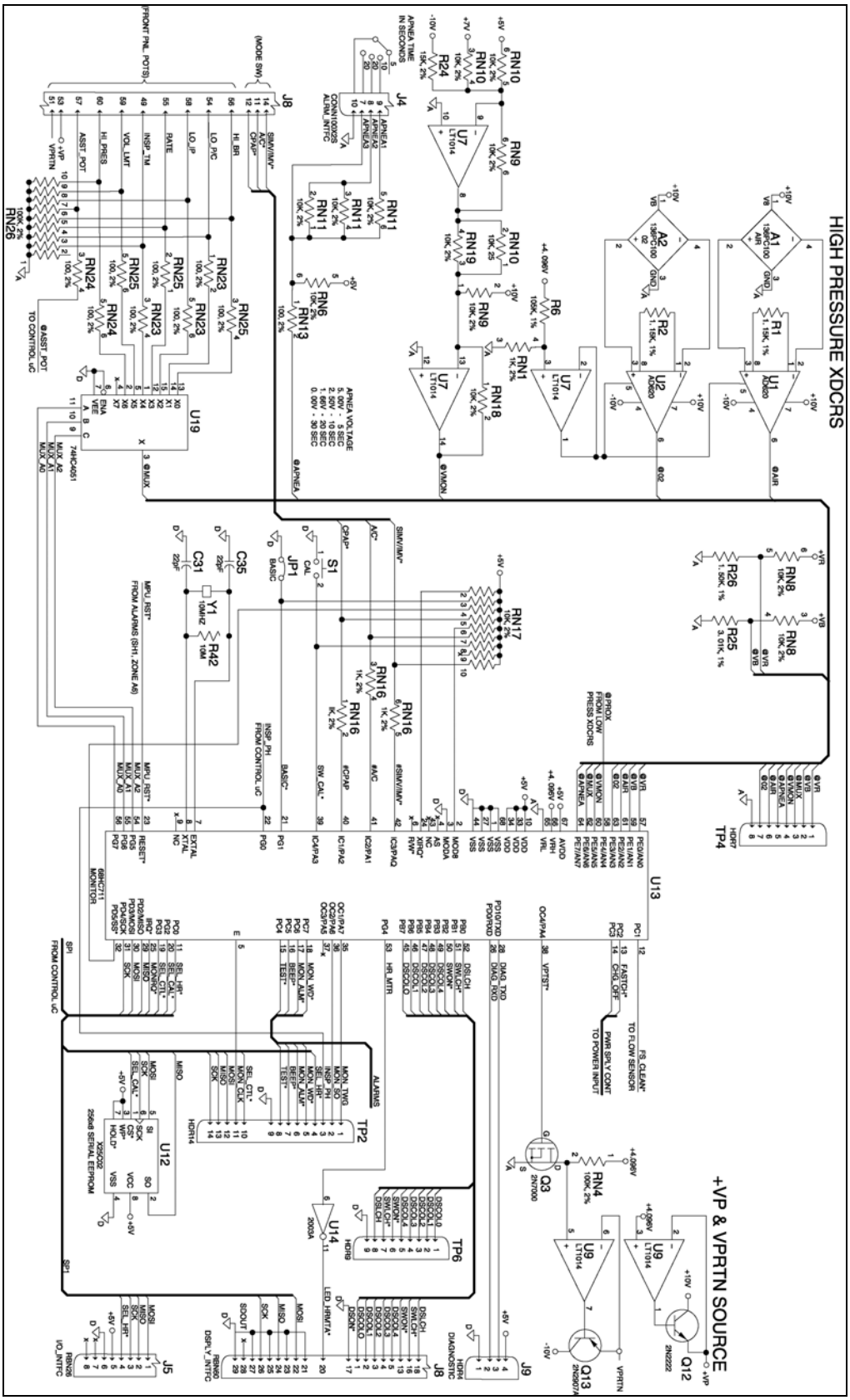

HIGH PRESSURE XDCRS
+VP & VPRTN SOURCE
U1
U2
U7
U9
U12
U13
U14
U19
Q3
Q12
Q13
J4
J5
J8
J9
TP2
TP4
TP6
A1
A2
R1
R2
R6
R24
R25
R26
RN1
RN4
RN6
RN8
RN9
RN10
RN11
RN12
RN13
RN16
RN17
RN18
RN19
RN23
RN24
RN25
C31
C35
Y1
R42
S1
JP1
APNEA TIME IN SECONDS
APNEA VOLTAGE
5.00V - 5 SEC
2.50V - 10 SEC
1.66V - 20 SEC
1.00V - 30 SEC
(MODE SW)
(FRONT PNL POTS)
ASST_POT TO CONTROL uC
MPU_RST* FROM ALARMS (SH1, ZONE A6)
INSP_PH FROM CONTROL uC
SPI FROM CONTROL uC
TO FLOW SENSOR
PWR SPLY CONT TO POWER INPUT
DIAGNOSTIC
X25032 32x8 SERIAL EEPROM
2N7000
2N2222
2N2907A
LT1014
74HC4051
ALARMS

Figure 5-16:

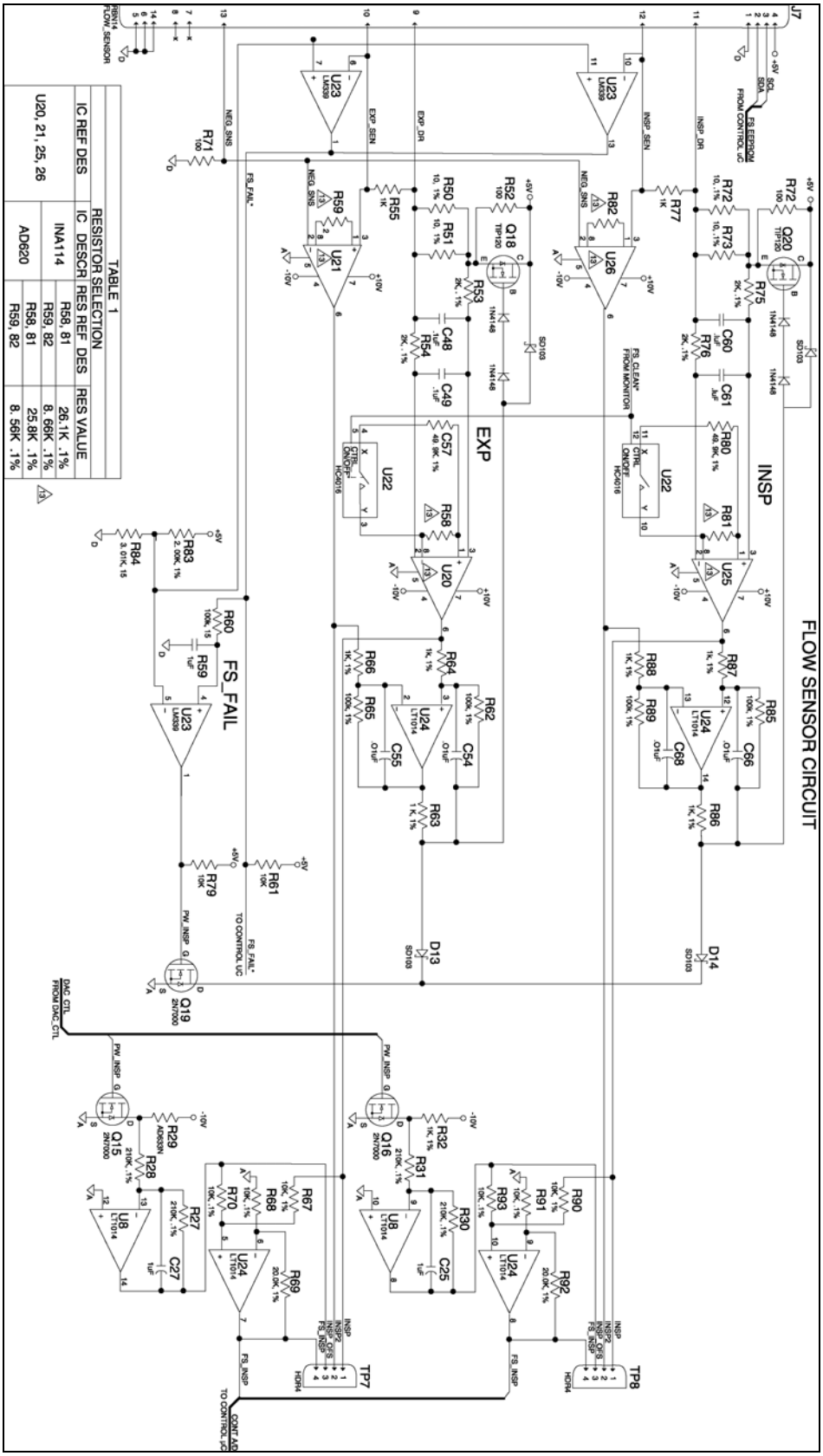

FLOW SENSOR CIRCUIT
EXP
INSP
FS_FAIL
TABLE 1
RESISTOR SELECTION
IC REF DES
IC DESCR
RES REF DES
RES VALUE
U20, 21, 25, 26
INA114
R58, 81
26.1K .1%
R59, 82
8.66K .1%
AD620
R58, 81
25.5K .1%
R59, 82
8.56K .1%

Figure 5-17:

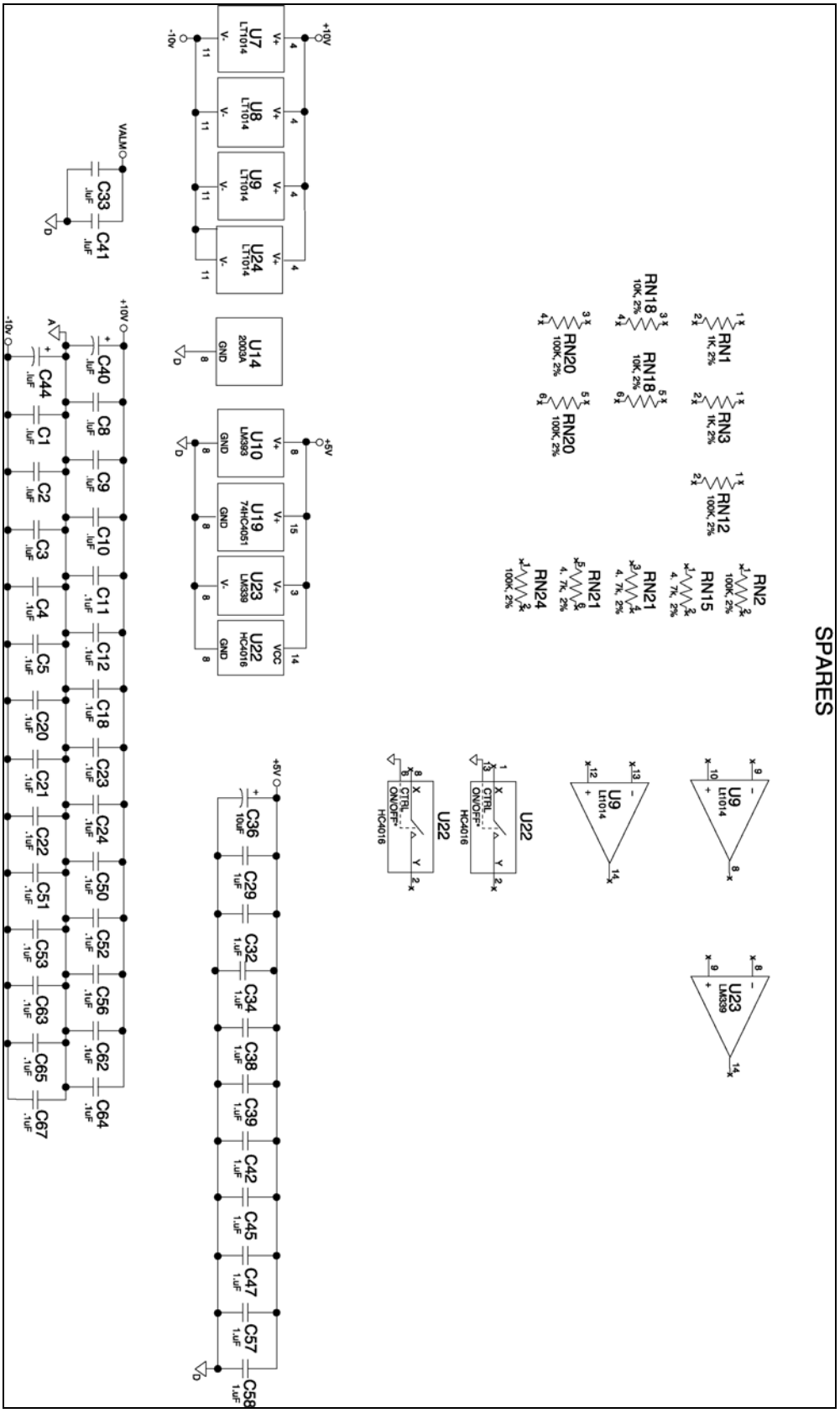

SPARES
RN1 1K, 2%
RN3 1K, 2%
RN12 100K, 2%
RN2 100K, 2%
RN15 4. 7K, 2%
RN18 10K, 2%
RN18 10K, 2%
RN21 4. 7K, 2%
RN20 100K, 2%
RN20 100K, 2%
RN21 4. 7K, 2%
RN24 100K, 2%
U9 LT1014
U9 LT1014
U23 LM339
U22 HC4016
U22 HC4016
U22 HC4016
CTRL ON/OFF
U7 LT1014
U8 LT1014
U9 LT1014
U24 LT1014
U14 2003A
U10 LM393
U19 74HC4051
U23 LM339
U22 HC4016
+10V
-10v
+5V
VALM
C33 .1uF
C41 .1uF
C40 .1uF
C44 .1uF
C8 .1uF
C1 .1uF
C9 .1uF
C2 .1uF
C10 .1uF
C3 .1uF
C11 .1uF
C4 .1uF
C12 .1uF
C5 .1uF
C18 .1uF
C20 .1uF
C23 .1uF
C21 .1uF
C24 .1uF
C22 .1uF
C50 .1uF
C51 .1uF
C52 .1uF
C53 .1uF
C56 .1uF
C63 .1uF
C62 .1uF
C65 .1uF
C64 .1uF
C67 .1uF
C36 10uF
C29 1uF
C32 1uF
C34 1uF
C38 1uF
C39 1uF
C42 1uF
C45 1uF
C47 1uF
C57 1uF
C58 1uF

Figure 5-18:

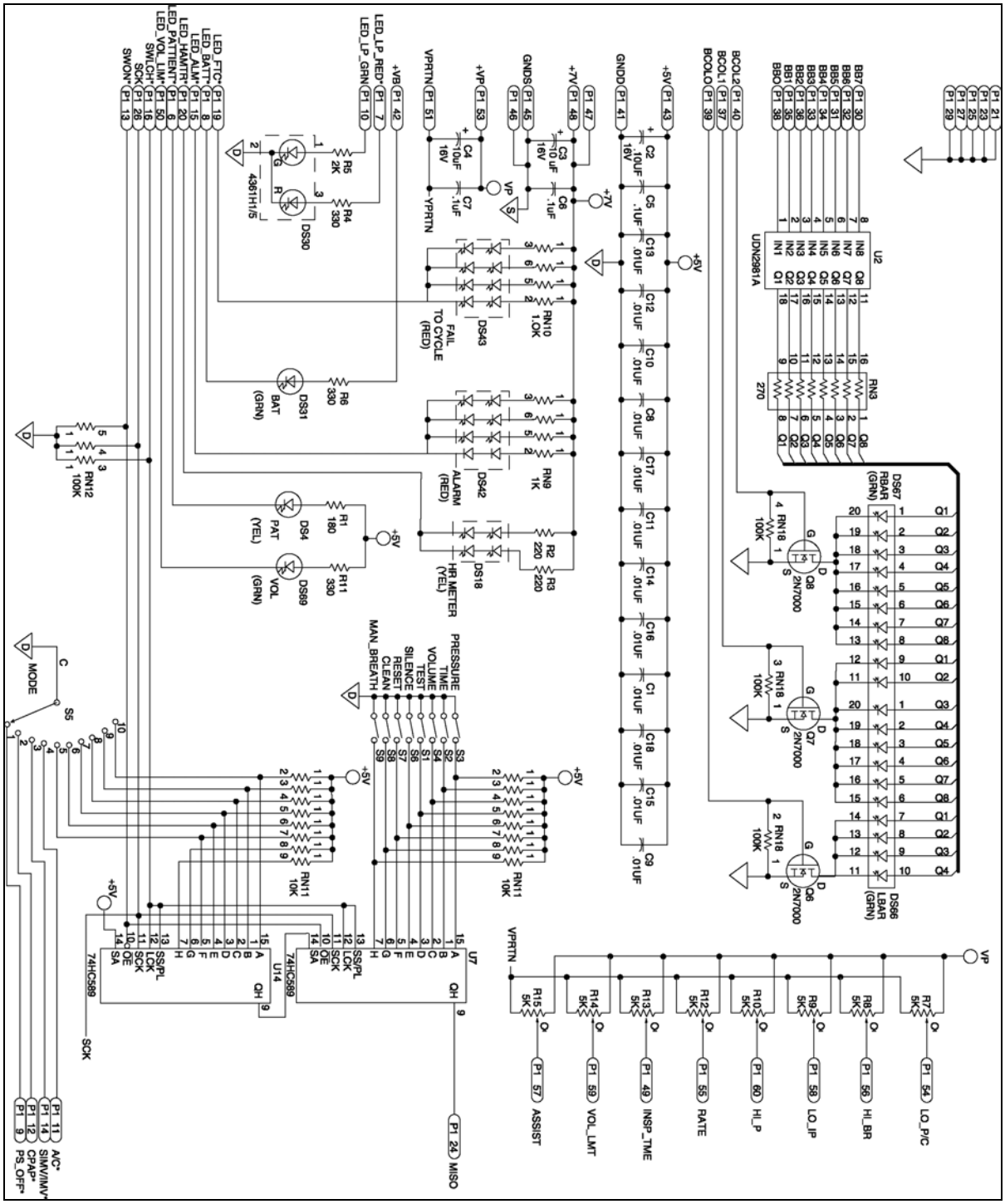


Figure 5-19:

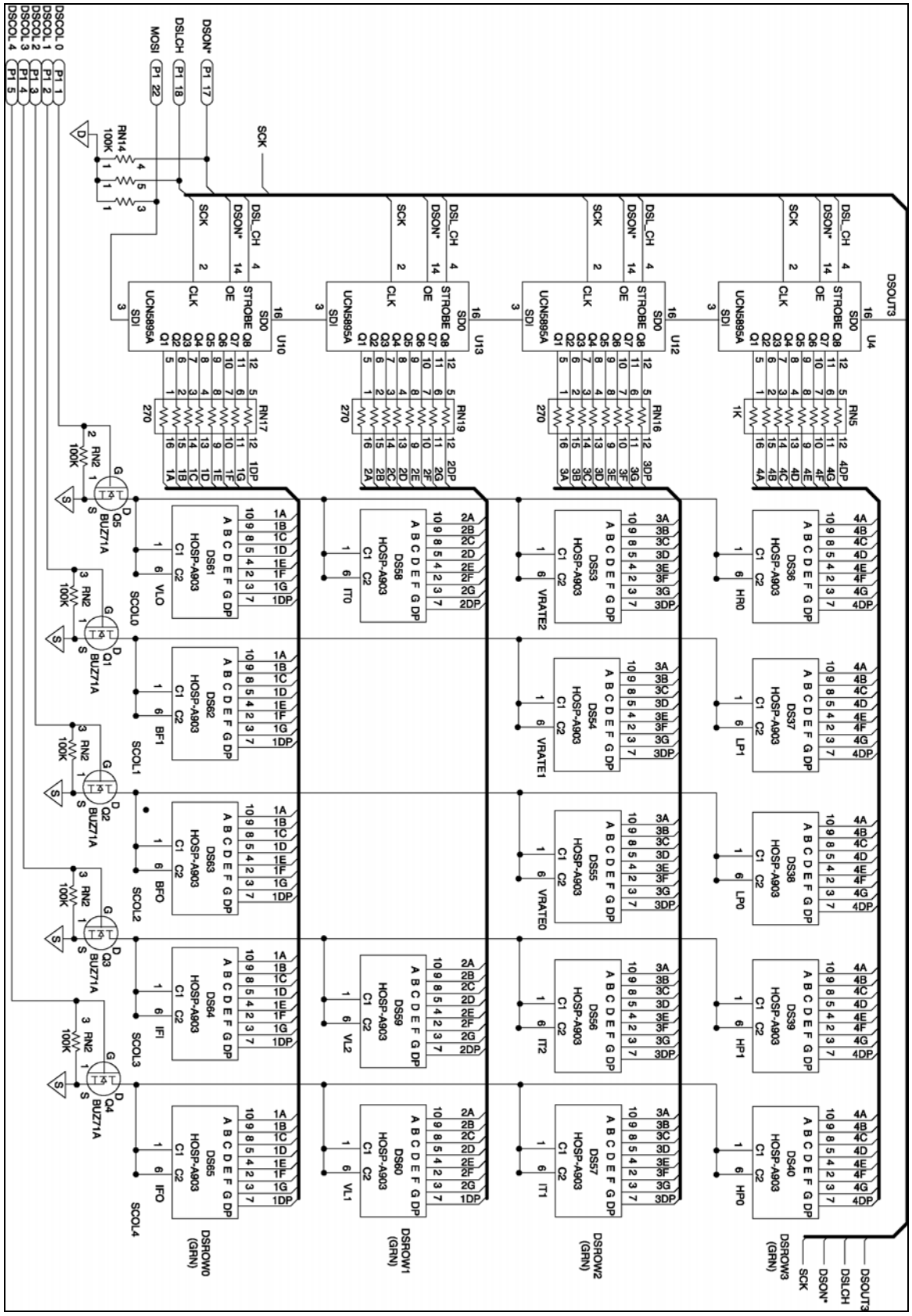

DSOUT3
DSLCH
DSON*
SCK
DSROW3 (GRN)
DSROW2 (GRN)
DSROW1 (GRN)
DSROW0 (GRN)
U4
U10
U12
U13
UCN5895A
HOSP-A903
RN5
RN14
RN16
RN17
RN19
RN2
Q1
Q2
Q3
Q4
Q5
BUZ71A
VLO
BF1
BFO
IFI
IFO
VL1
VL2
IT0
IT1
IT2
VRATE0
VRATE1
VRATE2
HP0
HP1
LP0
LP1
HR0
SCOL0
SCOL1
SCOL2
SCOL3
SCOL4
MOSI
DSCOL0
DSCOL1
DSCOL2
DSCOL3
DSCOL4

Figure 5-20:

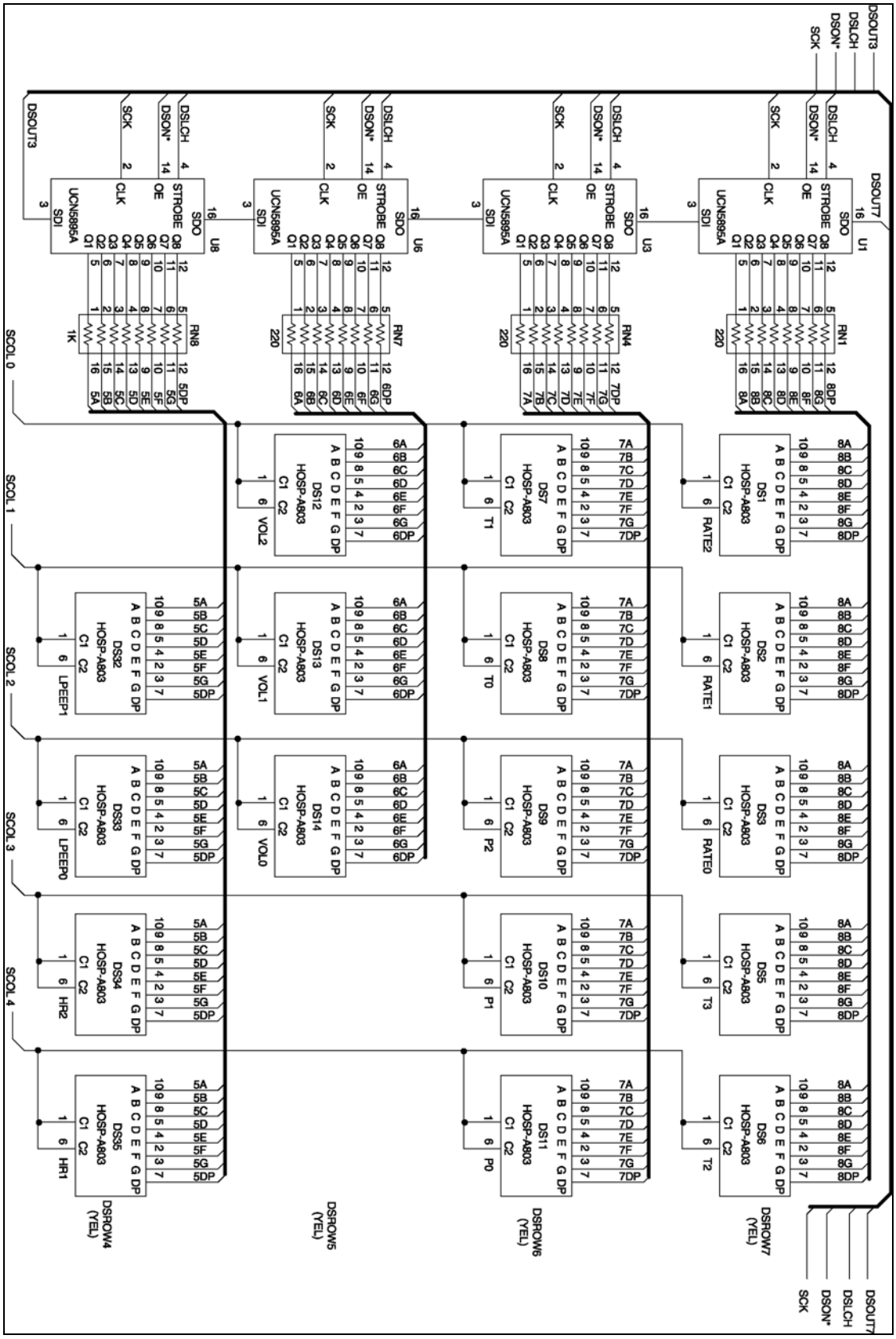

DSOUT3
DSLCH
DSON*
SCK
DSOUT7
U1
U3
U6
U8
UCN5895A
SDI
CLK
OE
STROBE
SDO
RN1
RN4
RN7
RN8
220
1K
SCOL0
SCOL1
SCOL2
SCOL3
SCOL4
DS1 HOSP-A803 RATE2
DS2 HOSP-A803 RATE1
DS3 HOSP-A803 RATE0
DS5 HOSP-A803 T3
DS6 HOSP-A803 T2
DS7 HOSP-A803 T1
DS8 HOSP-A803 T0
DS9 HOSP-A803 P2
DS10 HOSP-A803 P1
DS11 HOSP-A803 P0
DS12 HOSP-A803 VOL2
DS13 HOSP-A803 VOL1
DS14 HOSP-A803 VOL0
DS32 HOSP-A803 LPEEP1
DS33 HOSP-A803 LPEEP0
DS34 HOSP-A803 HR2
DS35 HOSP-A803 HR1
DSROW4 (YEL)
DSROW5 (YEL)
DSROW6 (YEL)
DSROW7 (YEL)

Figure 5-21:

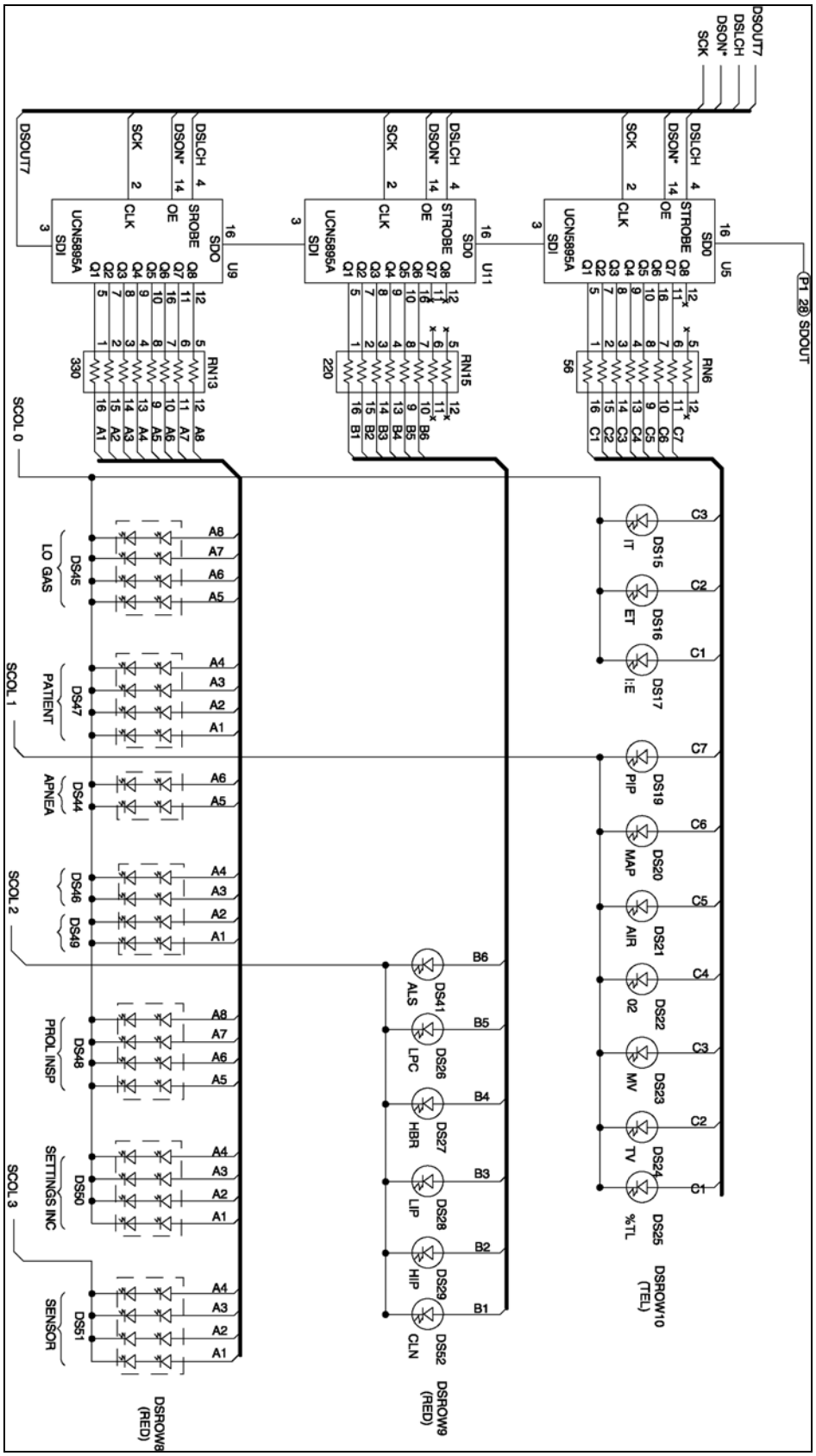

DSOUT7
DSLCH
DSON*
SCK
U5
U11
U9
SDO
SDI
CLK
OE
STROBE
UCN5895A
RN6
RN15
RN13
330
220
56
SCOL 0
SCOL 1
SCOL 2
SCOL 3
DS15
DS16
DS17
DS19
DS20
DS21
DS22
DS23
DS24
DS25
DS41
DS26
DS27
DS28
DS29
DS52
DS45
DS47
DS44
DS46
DS49
DS48
DS50
DS51
IT
ET
I:E
PIP
MAP
AIR
02
MV
TV
%TL
ALS
LPC
HBR
LIP
HIP
CLN
LO GAS
PATIENT
APNEA
PROL INSP
SETTINGS INC
SENSOR
DSROW10 (TEL)
DSROW9 (RED)
DSROW8 (RED)
P1 28 SDOUT

Figure 5-22:

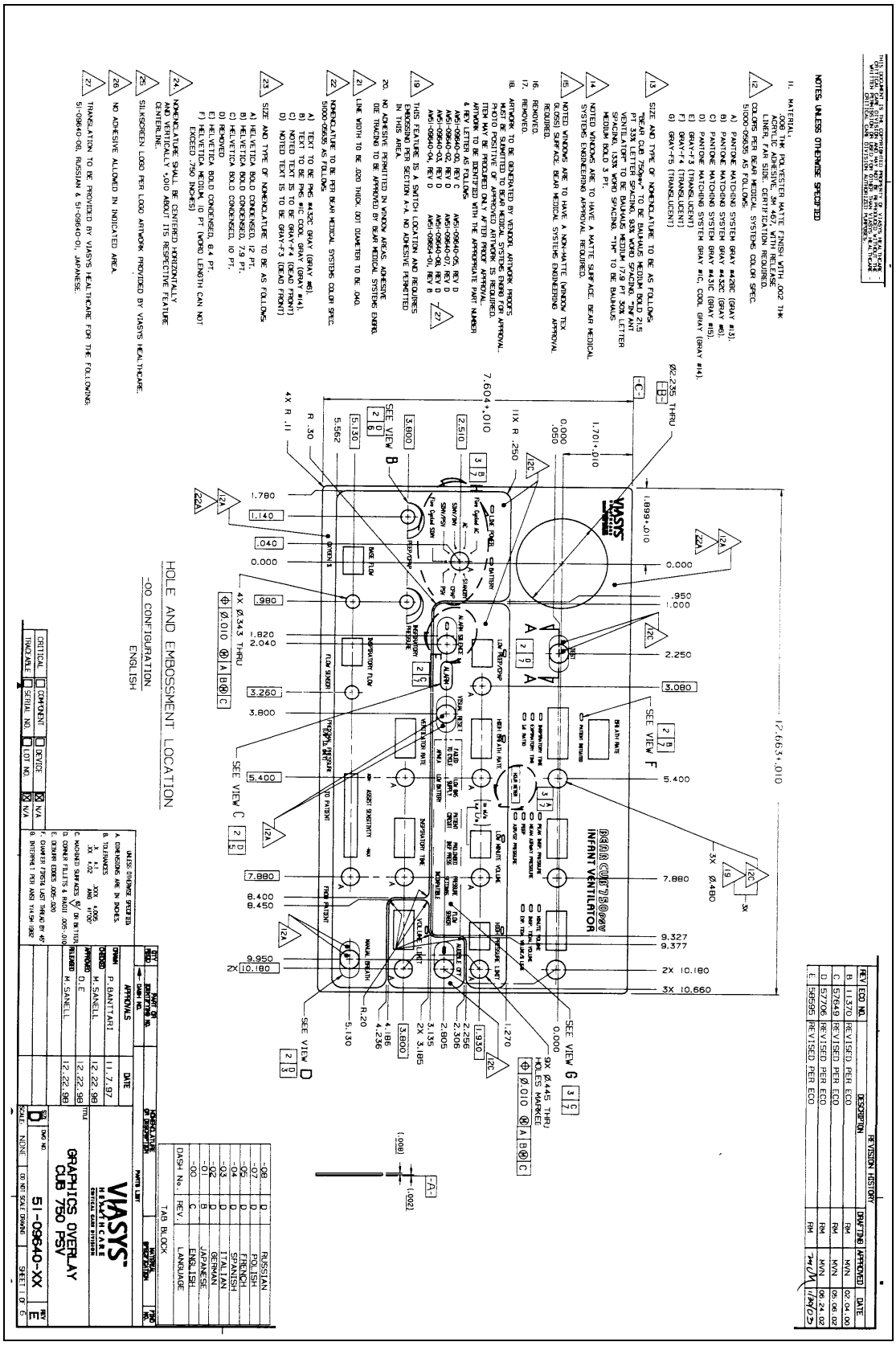


Figure 5-23:

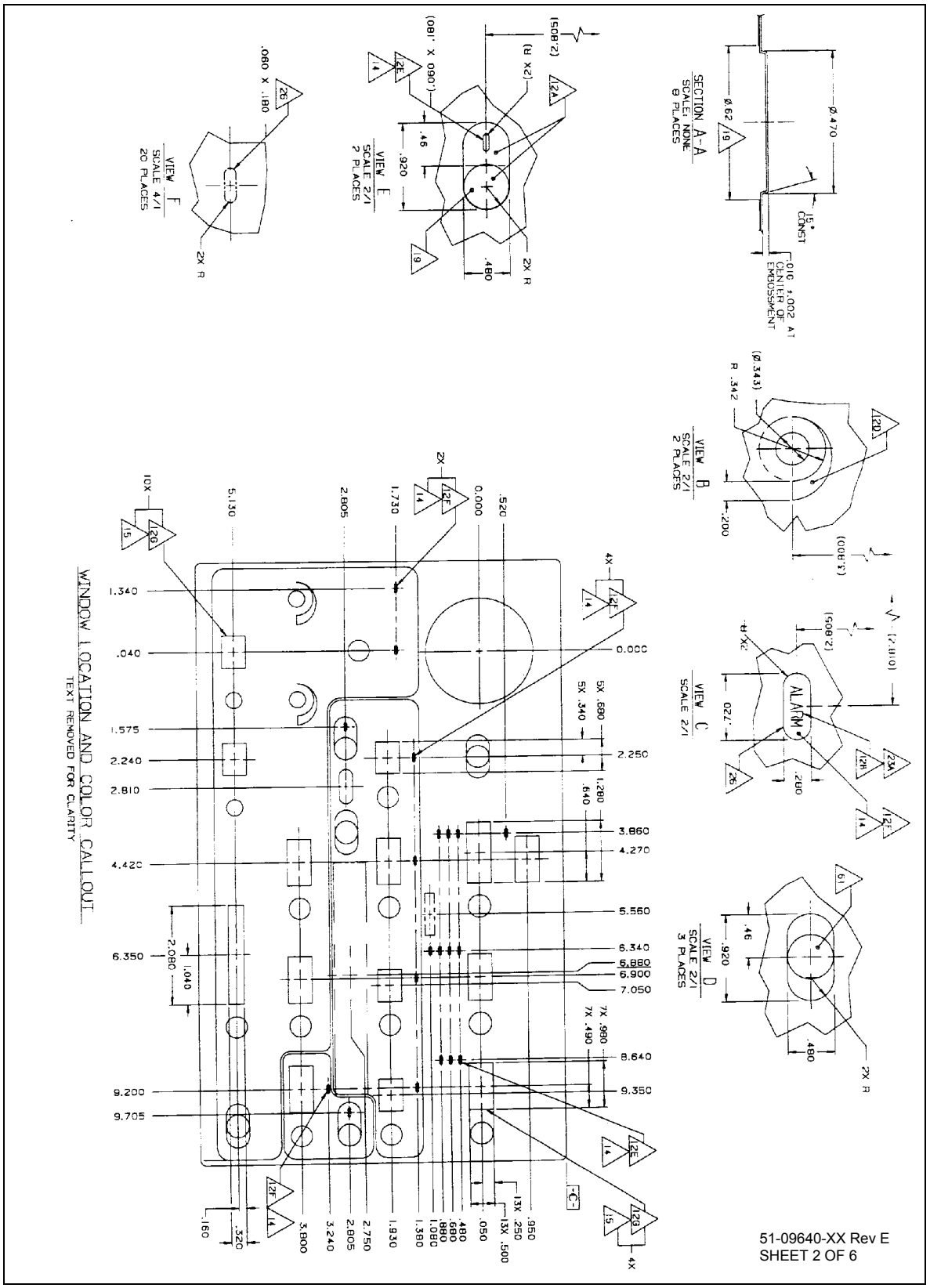

WINDOW LOCATION AND COLOR CALLOUT
TEXT REMOVED FOR CLARITY
51-09640-XX Rev E
SHEET 2 OF 6

Figure 5-24:

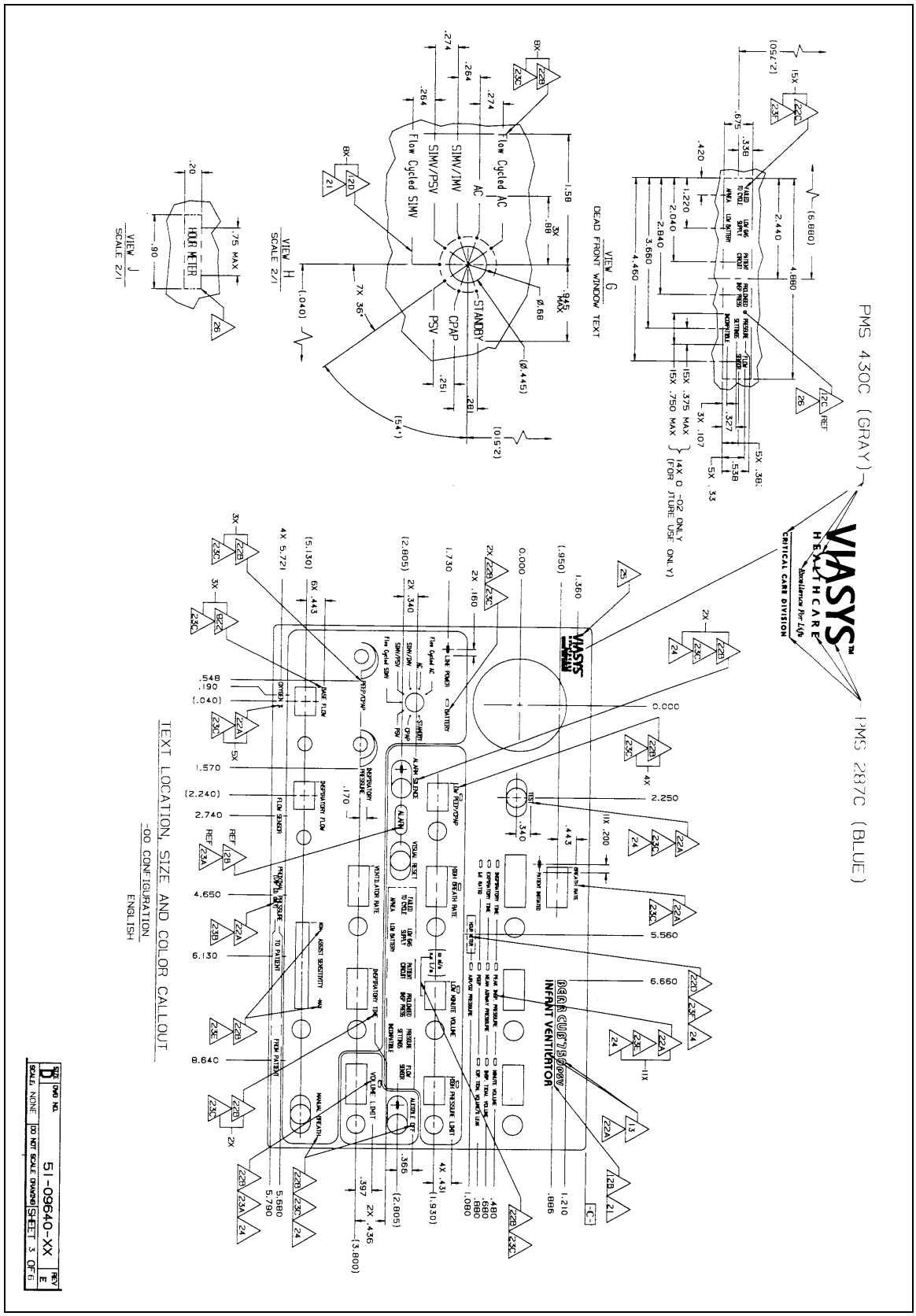

PMS 430C (GRAY)
PMS 287C (BLUE)
VIASYS HEALTHCARE
CRITICAL CARE DIVISION
INFANT VENTILATION
VIEW G
DEAD FRONT WINDOW TEXT
VIEW H
SCALE 2/1
VIEW J
SCALE 2/1
HOUR METER
Flow Cycled AC
SIMV/PSV
Flow Cycled SIMV
STANDBY
CPAP
PSV
TEXT LOCATION, SIZE AND COLOR CALLOUT
-00 CONFIGURATION
ENGLISH
51-09640-XX
SCALE NONE
DO NOT SCALE DRAWING
SHEET 3 OF 6

Figure 5-25:

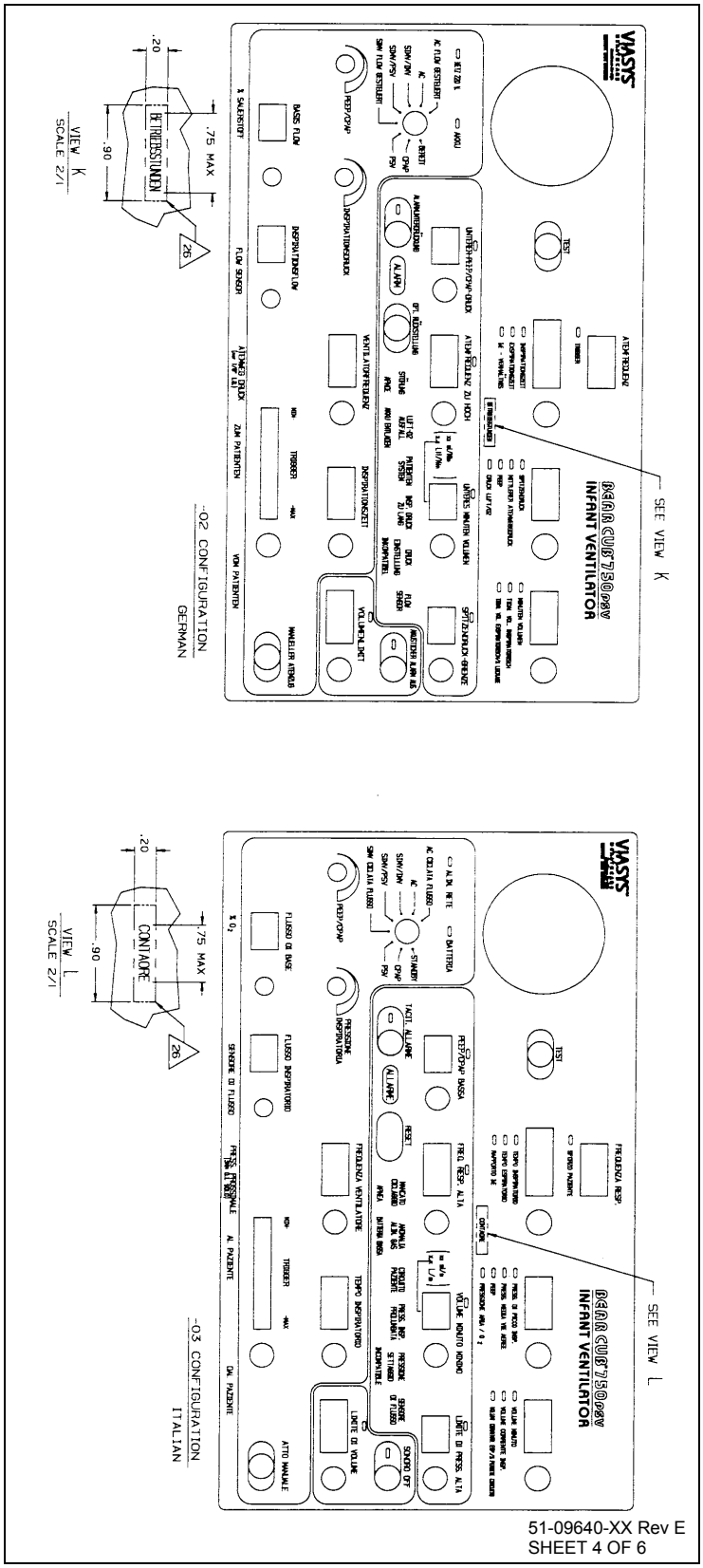

BEAR CUB 750PSV
INFANT VENTILATOR
SEE VIEW K
SEE VIEW L
VIEW K
SCALE 2/1
VIEW L
SCALE 2/1
.75 MAX
.90
.20
25
26
-02 CONFIGURATION
GERMAN
-03 CONFIGURATION
ITALIAN
51-09640-XX Rev E
SHEET 4 OF 6

Figure 5-26:

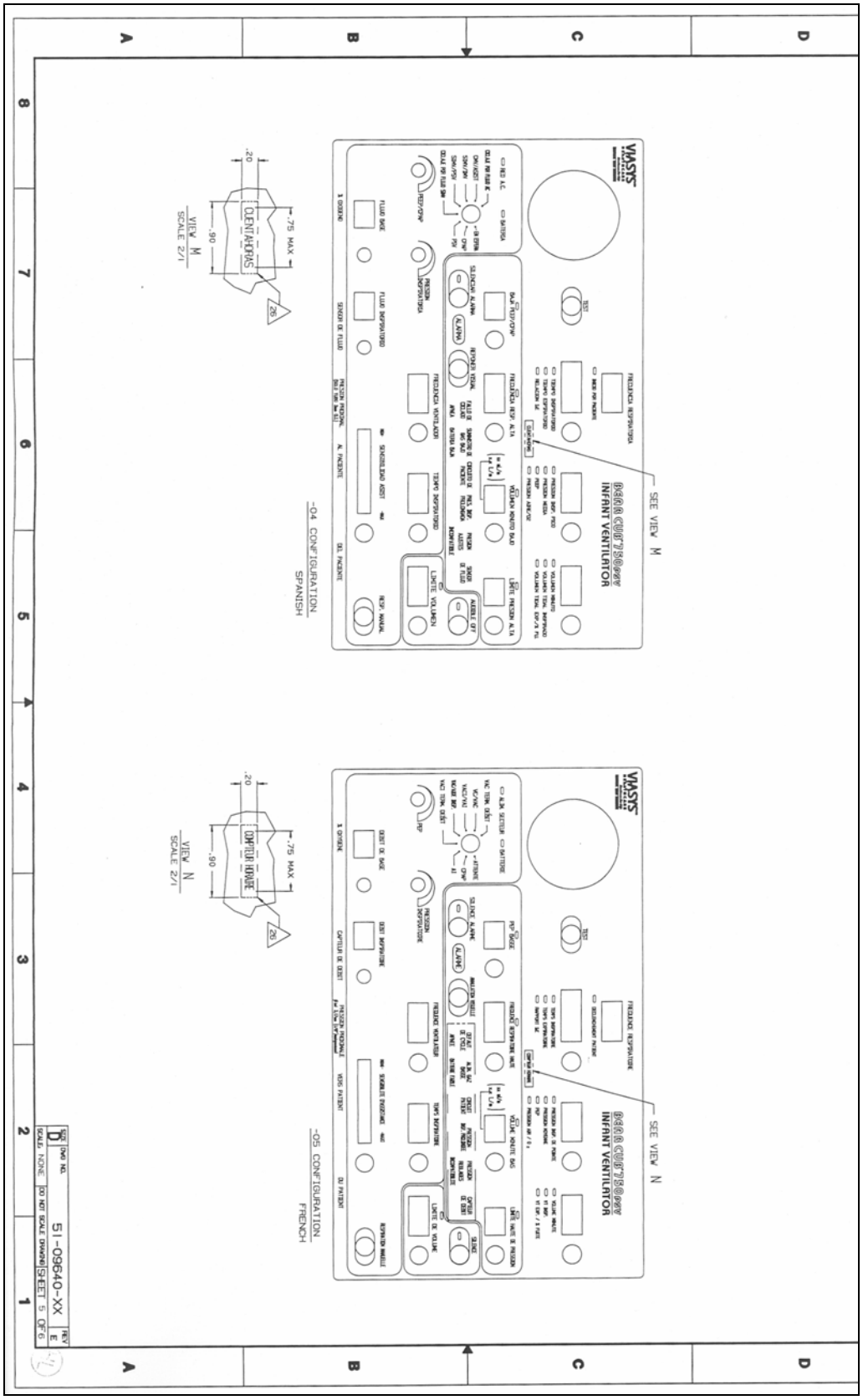

SEE VIEW M
SEE VIEW N
INFANT VENTILATOR
-04 CONFIGURATION
SPANISH
-05 CONFIGURATION
FRENCH
VIEW M
SCALE 2/1
VIEW N
SCALE 2/1
.75 MAX
.90
.20
26
51-09640-XX
SHEET 5 OF 6

Figure 5-27:

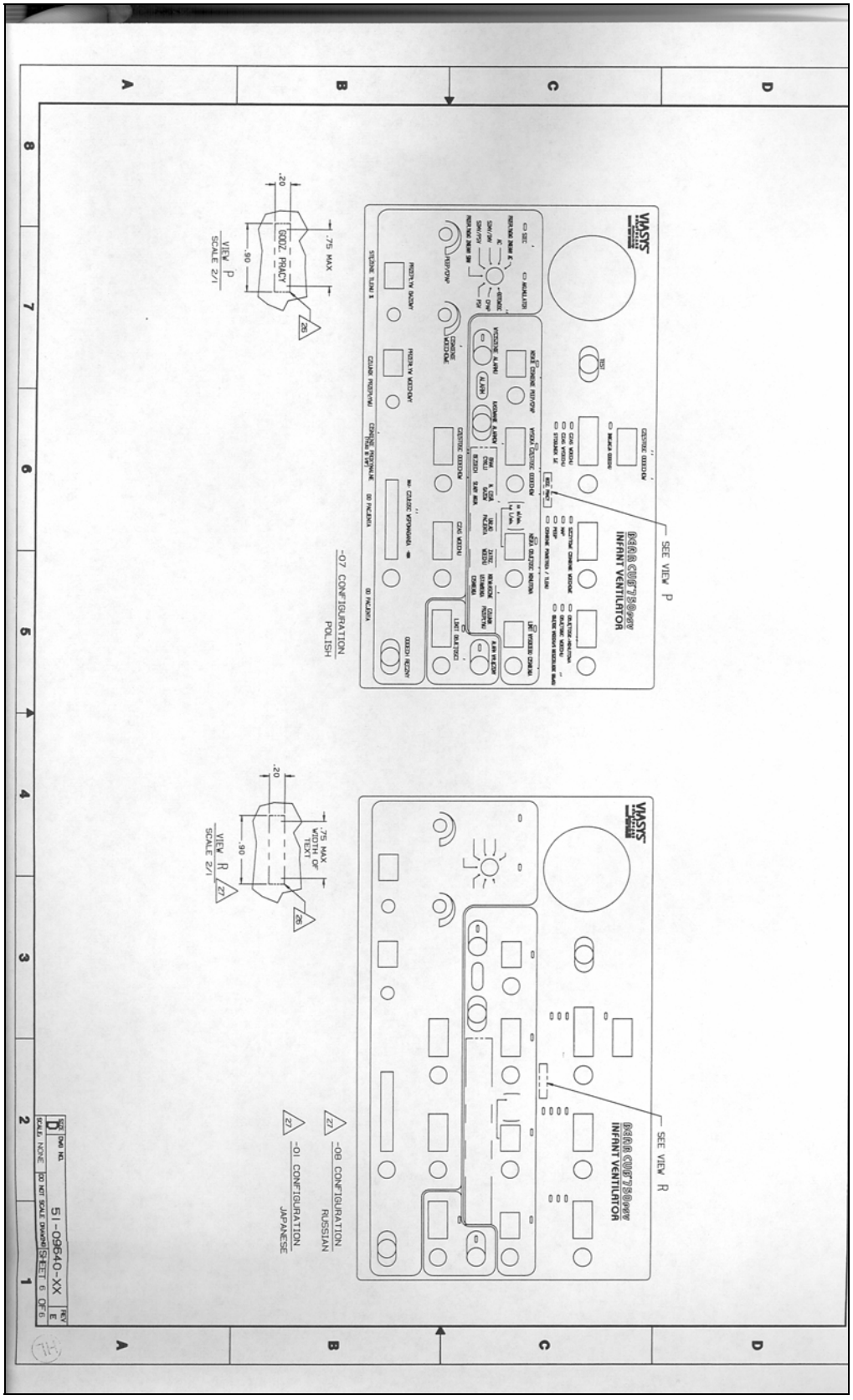

SEE VIEW P
INFANT VENTILATOR
VIEW P
SCALE 2/1
.75 MAX
-07 CONFIGURATION
POLISH
SEE VIEW R
INFANT VENTILATOR
VIEW R
SCALE 2/1
-08 CONFIGURATION
RUSSIAN
-01 CONFIGURATION
JAPANESE
51-09640-XX
SCALE: NONE
DO NOT SCALE DRAWING
SHEET 6 OF 6

Figure 5-28:

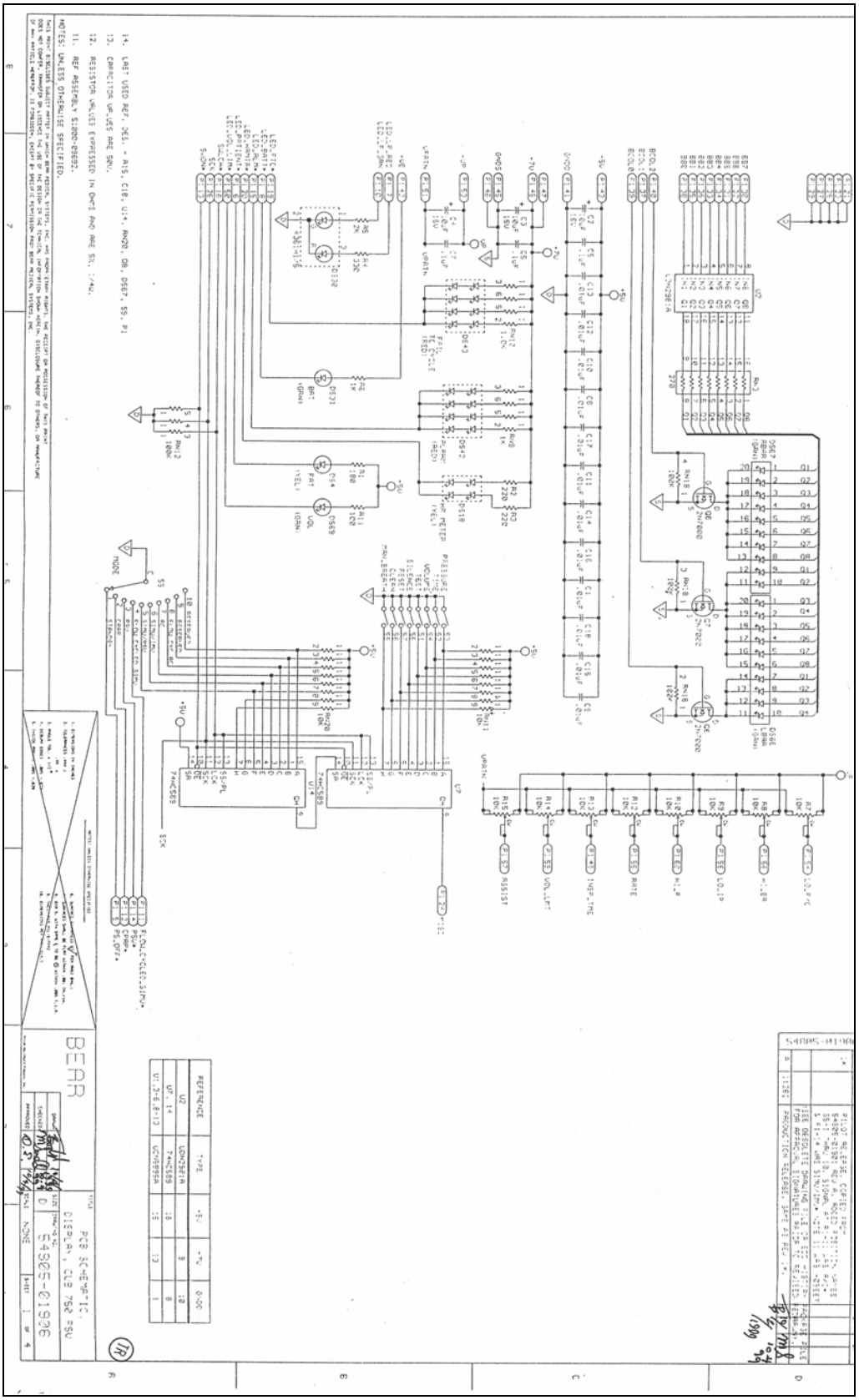


Figure 5-29:

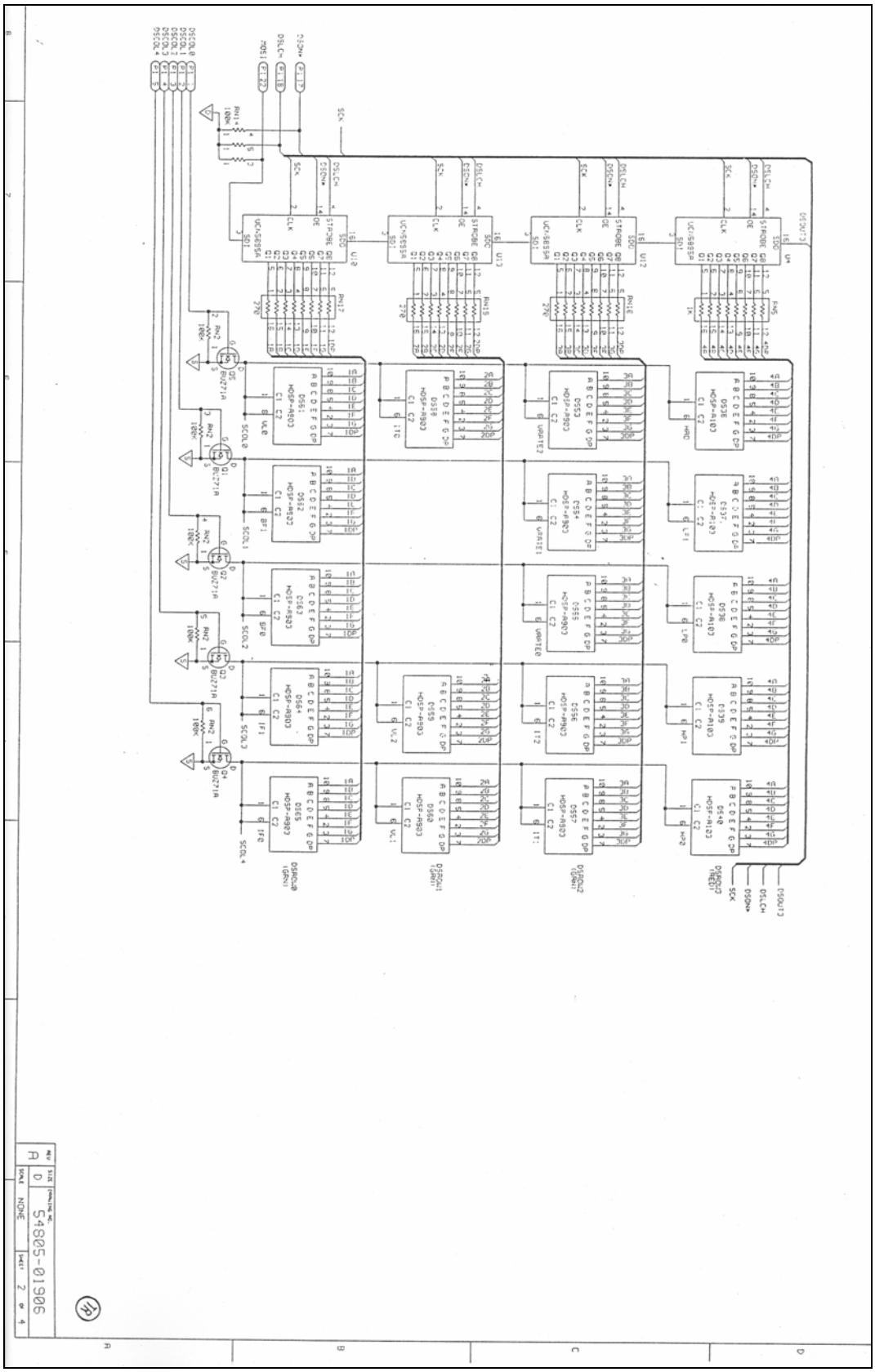


Figure 5-30:

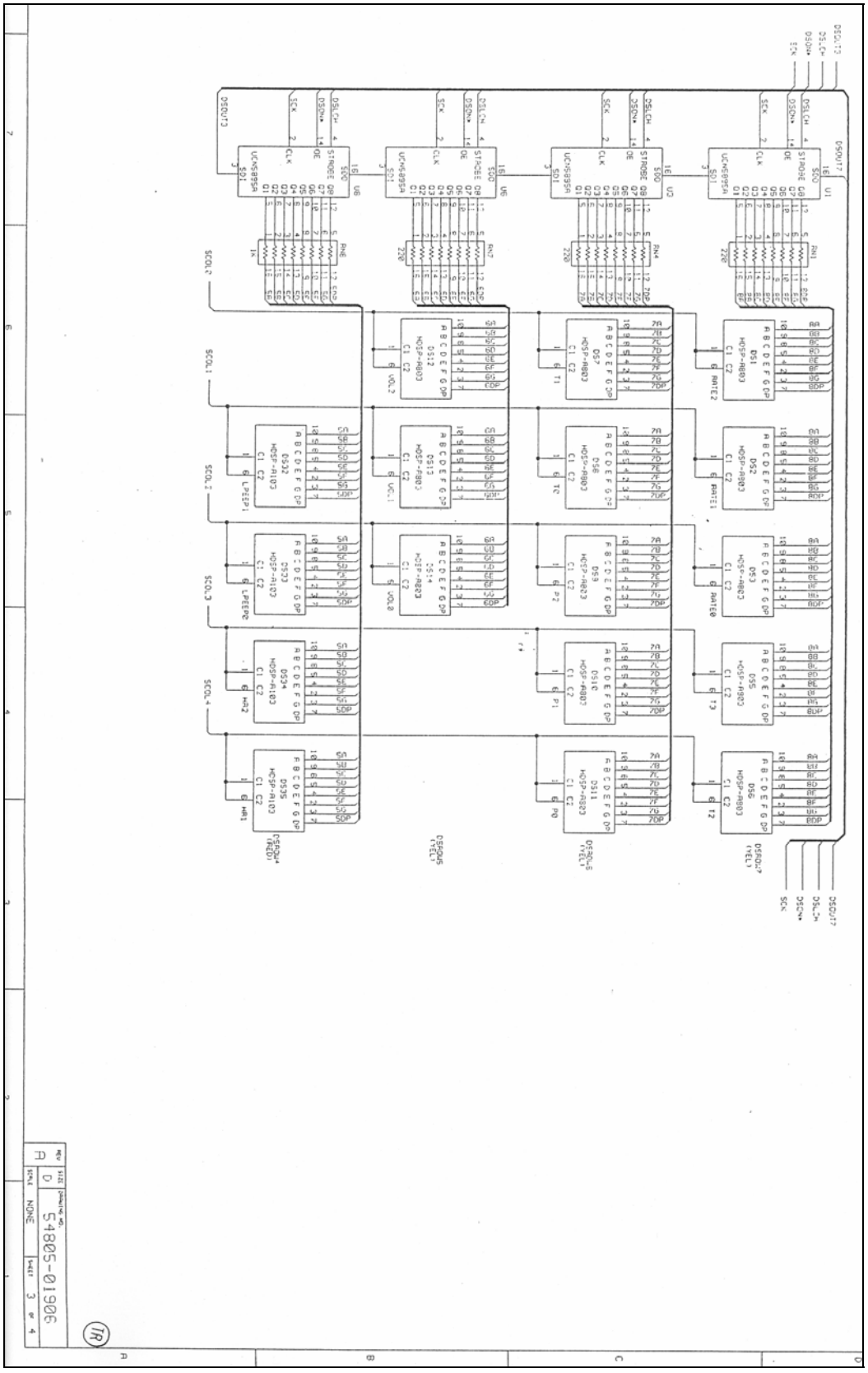


Figure 5-31:

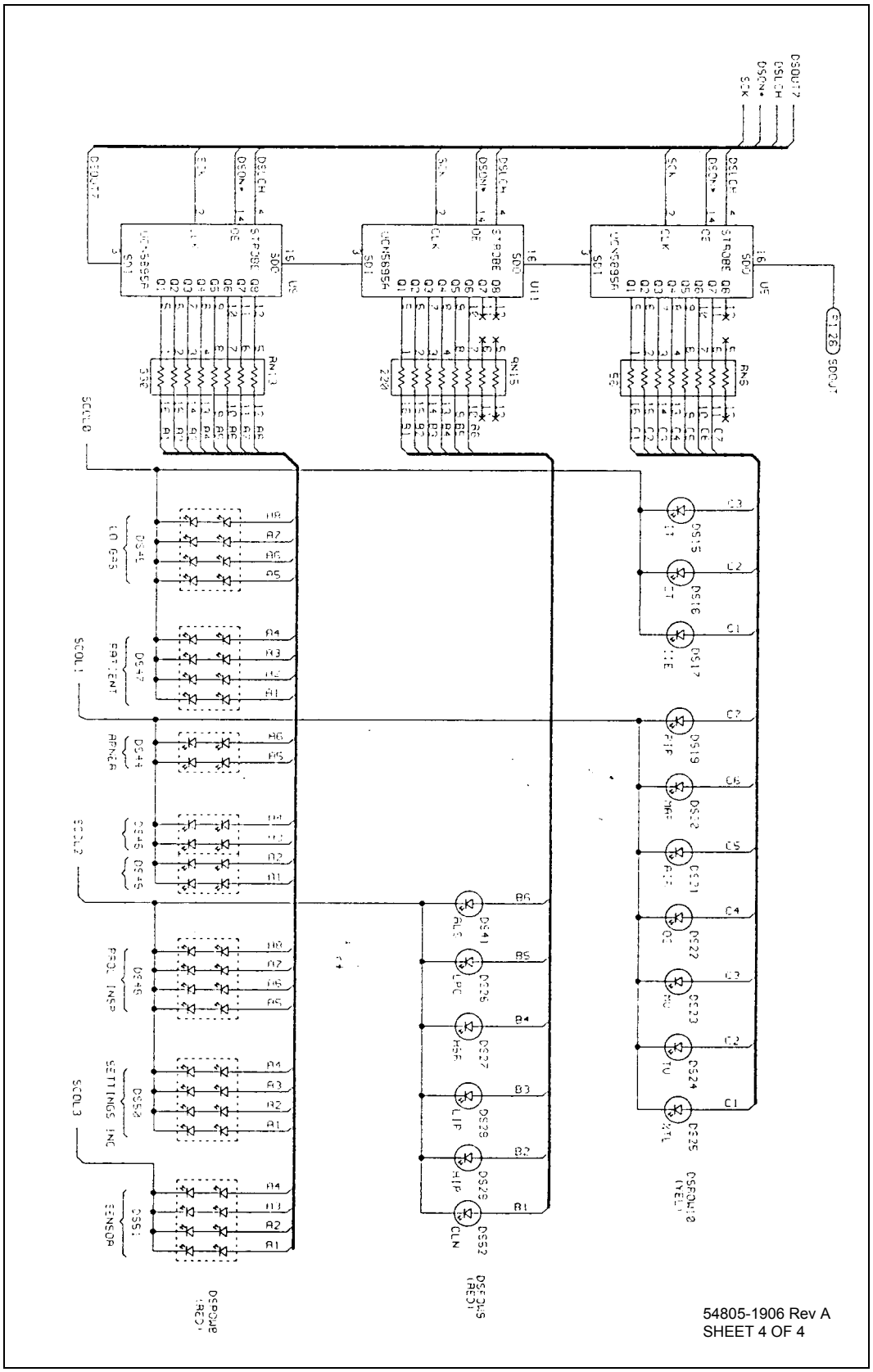


Figure 5-32:

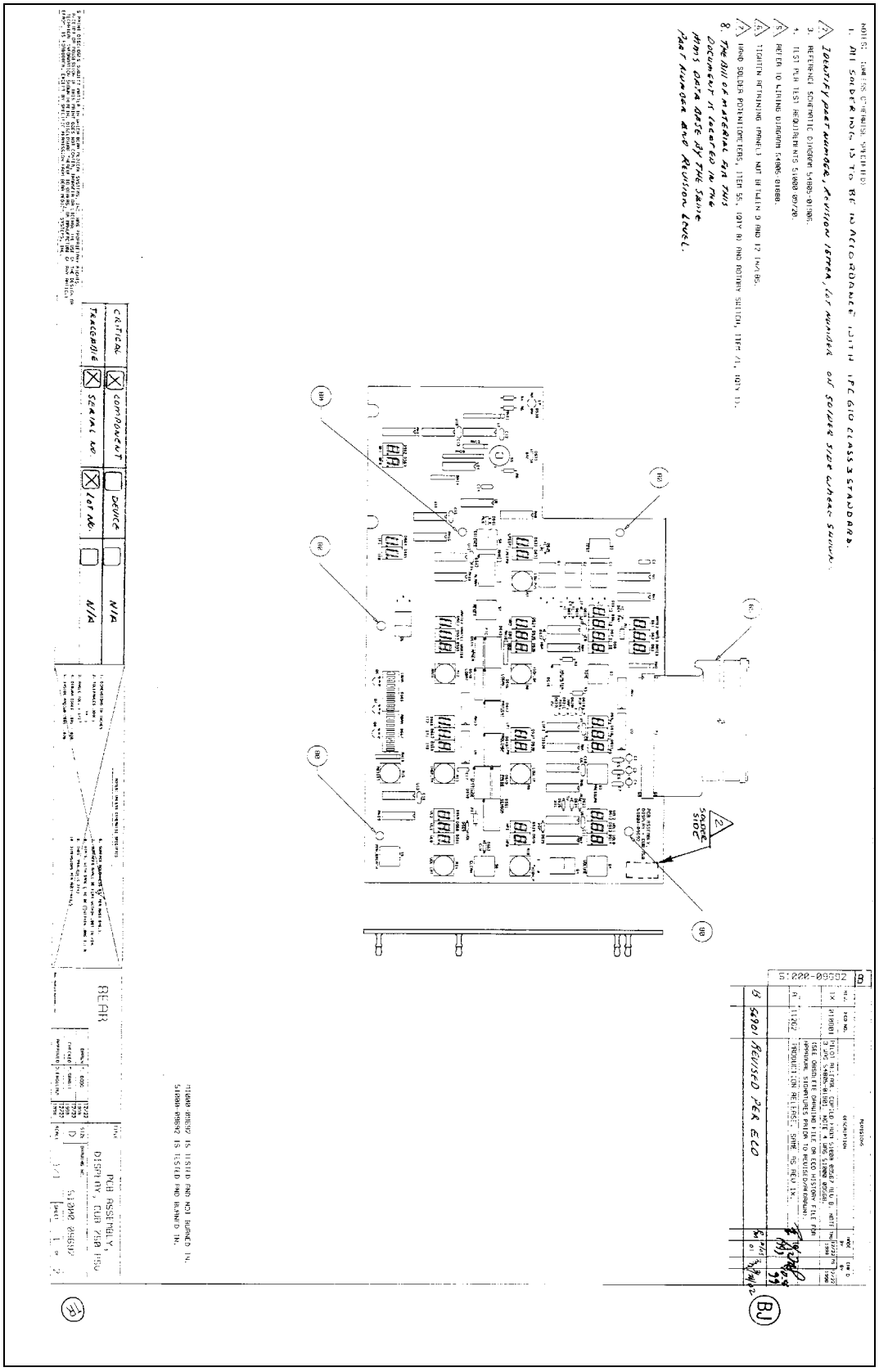


Figure 5-33:

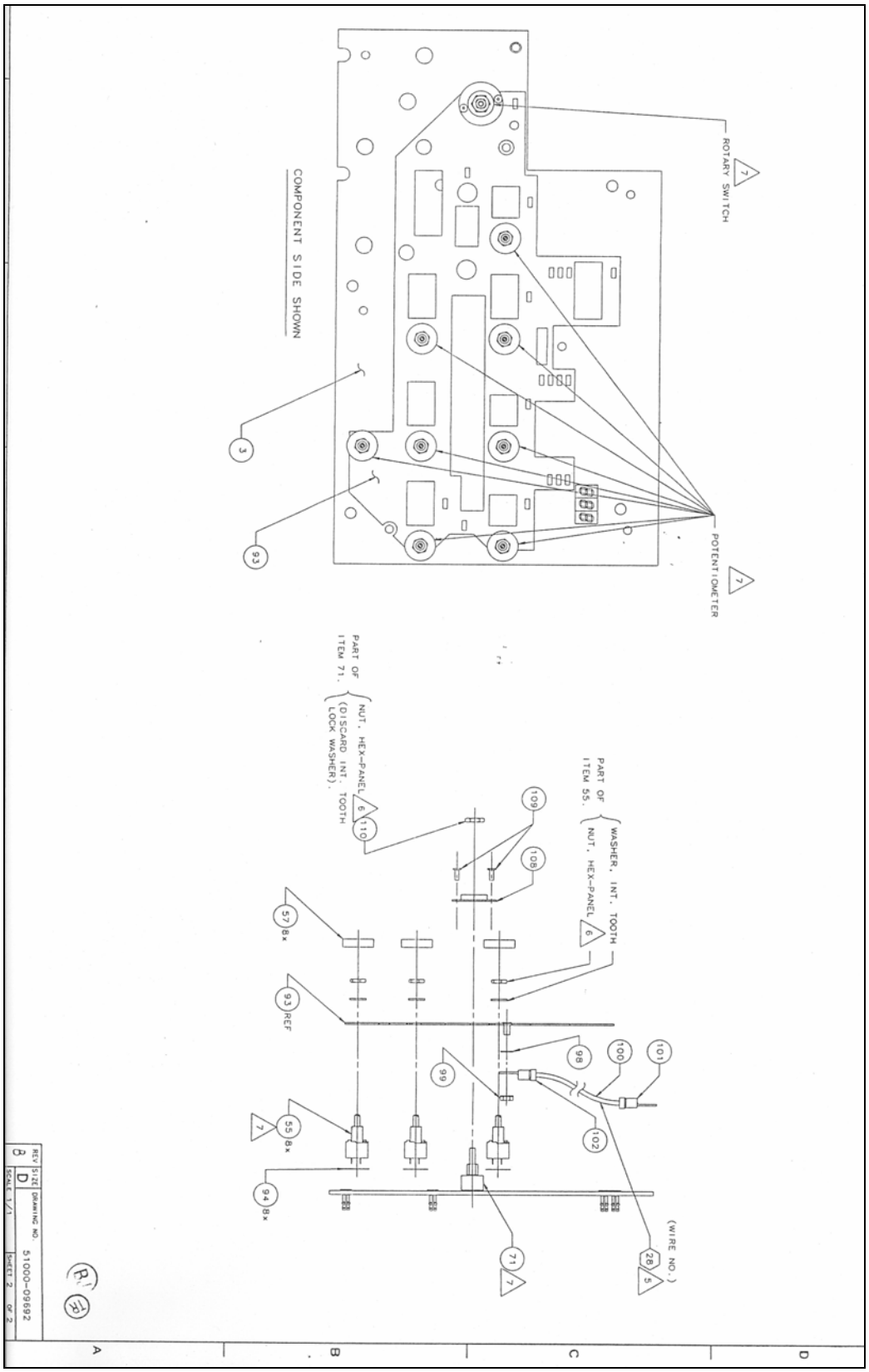

COMPONENT SIDE SHOWN
ROTARY SWITCH
POTENTIOMETER
PART OF ITEM 71.
NUT, HEX-PANEL
(DISCARD INT. TOOTH LOCK WASHER).
PART OF ITEM 55.
WASHER, INT. TOOTH
NUT, HEX-PANEL
(WIRE NO.)
51000-09692
SHEET 2 OF 2

Figure 5-34:

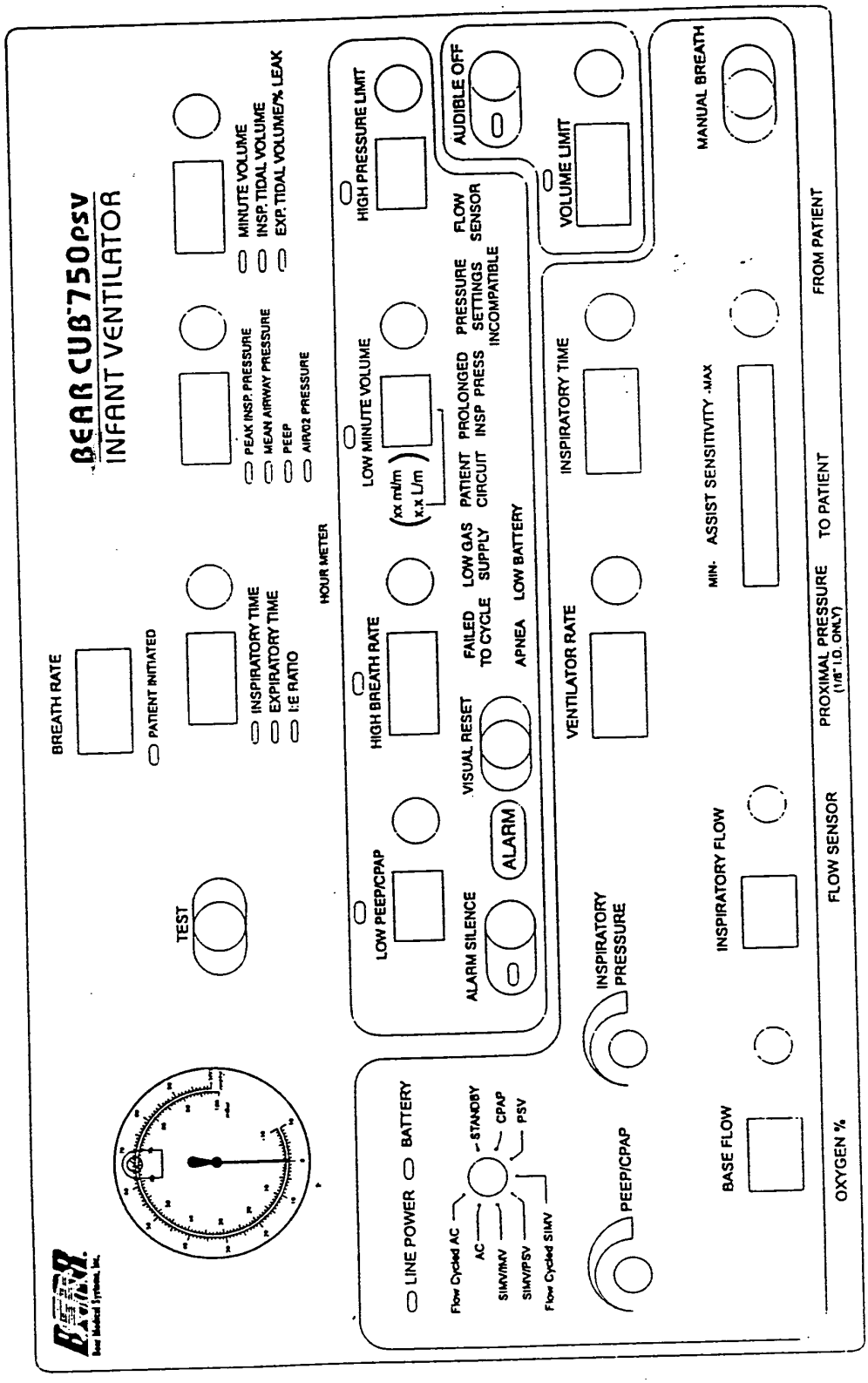

BEAR CUB 750psv
INFANT VENTILATOR
BREATH RATE
PATIENT INITIATED
TEST
INSPIRATORY TIME
EXPIRATORY TIME
I:E RATIO
HOUR METER
PEAK INSP. PRESSURE
MEAN AIRWAY PRESSURE
PEEP
AIRWAY PRESSURE
MINUTE VOLUME
INSP. TIDAL VOLUME
EXP. TIDAL VOLUME/% LEAK
HIGH PRESSURE LIMIT
AUDIBLE OFF
LOW MINUTE VOLUME
(xx ml/m
x.x L/m)
PATIENT CIRCUIT
PROLONGED INSP PRESS
PRESSURE SETTINGS INCOMPATIBLE
FLOW SENSOR
VOLUME LIMIT
LOW PEEP/CPAP
HIGH BREATH RATE
VISUAL RESET
FAILED TO CYCLE
LOW GAS SUPPLY
APNEA
LOW BATTERY
ALARM SILENCE
ALARM
VENTILATOR RATE
INSPIRATORY TIME
MANUAL BREATH
LINE POWER
BATTERY
Flow Cycled AC
AC
SIMV/PAV
SIMV/PSV
Flow Cycled SIMV
STANDBY
CPAP
PSV
INSPIRATORY PRESSURE
INSPIRATORY FLOW
MIN- ASSIST SENSITIVITY -MAX
PEEP/CPAP
BASE FLOW
OXYGEN %
FLOW SENSOR
PROXIMAL PRESSURE
(1/8" I.D. ONLY)
TO PATIENT
FROM PATIENT

Figure 5-35

Chapter 6 Troubleshooting

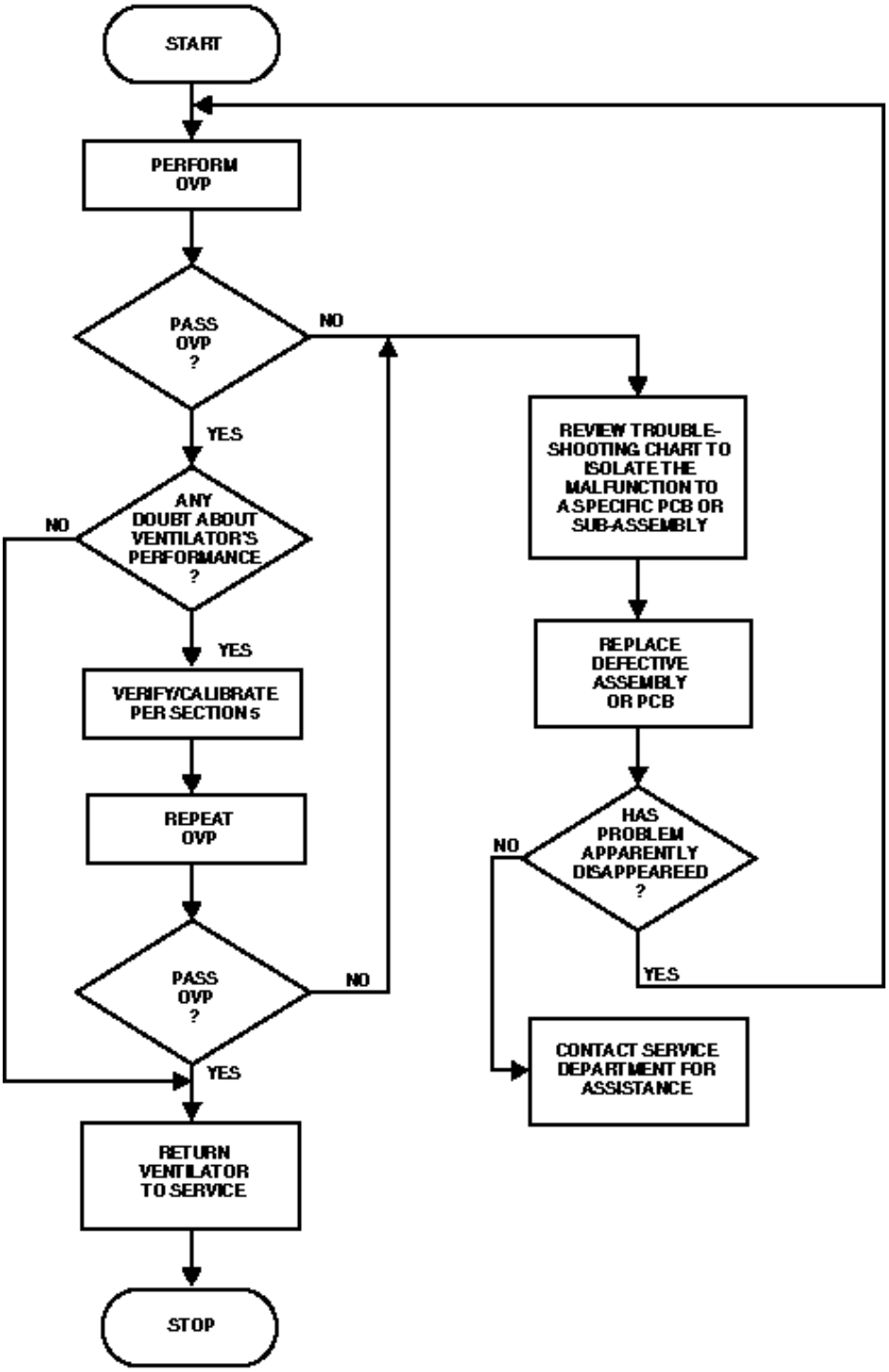


Figure 6-1: Troubleshotting Decision Tree

Table 6-2: Troubleshooting

Symptom	Possible Causes	Corrective Action
Failed To Cycle Alarm	1. Air and Oxygen Pressure Have Decreased Below 24 ± 2 PSIG. 2. Power Supply Failure. 3. System Supply Failure. 4. System Software Failure.	1. Verify Inlet Air and O_2 Pressure Entering The Ventilator. Verify Calibration of Air and Pressure Transducers On Control PCB. 2. Verify Power Supply Voltages At The 15 Pin Header Connection Labeled Tp1 On The Control PCB Per The Table Below. If Out of Specification, Replace Power Supply. **Voltage / Test Pt / Ground Pt** +5.0 VDC TP1-1 T1P-13 ± 5% (4.75-5.25) VDC +7.0 VDC TP1-6 TP1-7 ± 5% (6.65-7.35) VDC +10.0 VDC TP1-8 TP1-9 ± 5% (9.5-10.5) VDC -10.0 VDC TP1-10 TP1-9 ± 5% (10.5) VDC -15% (8.5) VDC 3. Remove and Replace Control PCB. 4. Remove and Replace System EEPROM (U-18 On Control PCB)
Low PEEP/CPAP and Low Inspiratory Pressure Alarms Faulty or Out of Specification.	1. Calibration Pressure Transducer. 2. Defective Pressure Transducer.	1. Calibrate Pressure Transducer Per Section 5 of This Manual. 2. Remove and Replace Control PCB.
Pressure Limit Control Does Not Function Correctly. Pressure Limit Not Within Specifications.	1. Calibration Pressure Transducer. 2. Defective Control PCB. 3. Defective Pressure Limit Valve.	1. Calibrate Pressure Transducer Per Section 5 of This Manual. 2. Remove and Replace Control PCB. 3. Remove and Replace Pressure Valve.
No Delivered Inspiratory Flow.	1. Defective Flow Control Solenoid Valve. 2. Defective Control PCB.	1. Remove and Replace Flow Control Valve Assembly 2. Remove and Replace Control PCB.
Base and/or Inspiratory Digital Flow Readings Do Not Agree With Actual Measured Flow.	1. Flow Valve Calibration.	1. Perform Flow Valve Calibration Per Section 5 of This Manual.
PEEP/CPAP Levels Will Not Adjust.	1. Defective PEEP Valve.	1. Remove and Replace PEEP Valve Assembly.
Oxygen Percentages Are Not Within Specification.	1. Air/O_2 Differential Pressure Greater Than ± 2 CmH_2O. 2. Air and/or O_2	1. Perform Differential Pressure Calibration Per Section 5 of This Manual. 2. Replace Air and/or Oxygen

Symptom	Possible Causes	Corrective Action
	Regulator(S) Defective. 3. Defective Oxygen Blender. 4. Defective Cross-Over Check Valve.	Regulator. 3. Replace Oxygen Blender. 4. Replace Defective Check Valve.
Front Panel Control(S) Will Not Adjust.	1. Defective Front Panel Potentiometer(S).	1. Remove and Replace Display PCB.
Base and Inspiratory Flow Cycles But No Pressure Building During Inspiration. No Flow Out of TO PATIENT Outlet.	1. Defective Dump Solenoid Valve. 2. Defective Control PCB. 3. Adjustable Overpressure Relief Valve Setting.	1. Remove and Replace Dump Solenoid Valve. 2. Remove and Replace Control PCB. 3. Evaluate/Adjust Valve Setting.
Pressure Settings Incompatible Alarm.	1. Inspiratory Pressure Level Set Below Peep/Cpap Level. 2. Control PCB Has Lost Calibration Data. 3. Defective Control PCB.	1. Evaluate Pressure Limit and PEEP/CPAP Level Settings. 2. Calibration Control PCB Per Section 5 of This Manual. 3. Remove and Replace Control PCB.
Ventilator Will Not Turn On.	1. Internal Battery Not Connected. 2. Internal Battery Discharged Below Minimum Operating Voltage. 3. Internal Battery Defective. 4. Ventilator Not Plugged In To Wall Ac Power.	1. Connect Internal Battery. 2. Re-Charge Internal Battery Connect Ventilator Power Cord To A Wall AC Outlet. 3. Remove and Replace Internal Battery. 4. Connect Ventilator Power Cord To A Wall AC Outlet.
Audible Alarm Does Not Activate.	1. Wiring Connection. 2. Defective Alarm Speaker. 3. Defective Control Pcb.	1. Verify Connection of P1 of Audible Alarm Cable To J1 of Controller Pcb. 2. Remove and Replace Alarm Speaker Sub-Assembly. 3. Remove and Replace Control Pcb.
Flow Sensor Alarm.	1. Flow Sensor Not Connected. 2. Flow Sensor Not Installed In Patient Circuit. 3. Occluded Flow Sensor and/or Endotracheal Tube. 4. Defective Flow Sensor.	1. Connect Flow Sensor To Both Ventilator Connector and 4 Way Patient Connector. 2. Install Flow Sensor. 3. Remove Occlusion. 4. Remove and Replace Flow Sensor.
"Settings Incompatible" Alarm; E.Fl. or E.Pl Flashing.	1. Incompatible Volume Limit Setting.	1. Evaluate Volume Limit Setting Versus Flow and Pressure Limit Settings.
Inspiratory Pressure Too Low.	1. Control Pin In Exhalation Valve Sticking. 2. Defective Exhalation Valve Diaphragm. 3. Defective Exhalation	1. Clean Control Pin. Verify Freedom of Movement. 2. Remove and Replace Exhalation Valve Diagram. 3. Remove and Replace Exhalation

Symptom	Possible Causes	Corrective Action
	Valve. 4. Adjustable Overpressure Relief Valve Setting. 5. Adjustable Overpressure Relief Valve Leaking (With 1 L/Min Flow Setting).	Valve. 4. Evaluate/Adjust Valve Setting. 5. Remove and Replace Aopr Valve.

Chapter 7 Removal & Replacement

WARNIINGS

- Disconnect all electrical power, air, and oxygen sources before attempting any disassembly. Failure to do so could result in injury to the service technician or damage to equipment.
- After replacement of any assembly(ies), always repeat the Operational Verification Procedure (refer to chapter 3), then allow a "burn-in" period and repeat the Operational Verification Procedure.

Interior Access

1. If connected, remove cables leading to RS-232 and Analog outputs ports of the ventilator.
2. Remove the seven screws indicated in Figure 8-1.
3. Slide the cover off of the unit applying slight pressure to the outside bottom portion of the cover.
4. Remove the two screws indicated in Figure 8-2. The standoff tubes will drop free when the screws are removed.

NOTE

The front portion will swing forward freely when the screws are removed. Take care to ensure that the front swings slowly to avoid damage to the unit.

5. The front portion of the unit will drop forward, stopping when the end of the retaining cord is reached. See Figure 8-3.

Flow Valve Assembly Removal

1. Disconnect hoses and connectors to the assembly.
2. Remove the four screws from the flow valve bracket, indicated in Figure 8-4.
3. Remove the Flow Valve Assembly from the unit.
4. To install, reverse removal procedure.

Control PCB Removal

1. Disconnect all hoses and connectors from the board.
2. Remove screw shown in Figure 8-5.
3. Lift board carefully from four retainer points.
4. Remove board from unit.
5. To install, reverse removal procedure.

Display PCB Removal

1. Remove control PCB . See Control PCB Removal Figure 8-5.
2. Remove five screws shown in Figure 8-6.
3. Disconnect ground wire.
4. Remove board from unit.
5. To install, reverse removal procedure.

Air/O_2 Regulator Removal

1. Remove Air/O_2 fittings from the rear of the ventilator. See Figure 8-7.
2. Remove all hoses necessary to free the regulator assembly.
3. Remove three screws on rear panel.
4. Remove assembly from ventilator. See Figure 8-8

Blender Removal

1. Remove all hoses and wiring connected to the blender.
2. Loosen allen screws of knob located on the front of the ventilator. Remove knob. See Figure 8-9.
3. Remove three screws located behind the knob. See Figures 8-10 and 8-11
4. Remove blender from unit.
5. To install, reverse order of removal.

Exhalation Valve Removal

1. Remove all hoses and wiring connected to the valve.
2. Remove three screws located on mounting plate. See Figure 8-12.
3. Remove Exhalation Valve from the ventilator.
4. To install, reverse removal procedure.

Chapter 8 Preventive Maintenance

Replacement Parts

50000-13040 PM Kit contains the following parts:

Air Inlet Disc Filter (1)	52000-00551
O-ring (1)	53021-01012
O2 Inlet Disc Filter (1)	52000-00552
O-ring (1)	53021-01011
Prox Line Filter (1)	51000-01122
Flow Valve Input Filter (1)	52000-01187
Flow Solenoid Pilot Filter (1)	52000-02097
Air Regulator (1)	52000-00129

Install the following parts using this document and related documents mentioned. Perform Calibration Verification Procedure and Operational Verification Procedure as described.

Recommended Service Procedure

Preventive Maintenance on the BEAR CUB™ 750vs Infant Ventilator should be completed at least once per year. Maintenance is intended to be done in the hospital by a Bear Medical Products Authorized Service Technician or a Bear Medical Products Trained Hospital Service Technician.

Ventilator Preventive Maintenance includes:

- Visually inspecting and cleaning of external surfaces, controls, attachments and accessories.
- Opening and cleaning the interior of the unit.
- Visually inspecting all tubing, electrical wiring, connectors, and crimps, screws, nuts and hardware. Checking the general condition of all other internal components or assemblies.
- Replacing the Air and O_2 filters.
- Replacing the Air and O_2 inlet bowls and seals.
- Pneumatic and electronic verification and calibrating if required.
- Performing the Operational Verification Procedure.

CAUTION

Before using any test equipment (Electronic or Pneumatic) for calibration procedures (other than Operational Verification), the accuracy of the instruments must be certified by a testing laboratory. The laboratory master test instruments must be traceable to the U.S. Bureau of Standards or Equivalent. When variances exist between indication and actual values, the calibration curves provided for each instrument by the testing laboratory must be used to establish the actual correct values. This certification should be performed at least once every six months. More frequent certification may be required based on usage and environment.

Exterior Inspection

1. Turn off the ventilator and disconnect from AC power and pressurized gas at the wall sources.
2. Clean the exterior of the unit with water or a solution of 70% Isopropyl Alcohol solution only. Wipe all surfaces with a soft cloth or disposable wipe moistened in the cleaning solution.
3. Inspect the exterior surfaces of the ventilator for broken or loose knobs. Check the display panel for scratches, cracks and alignment of LED indicators. Check all front and rear panel fittings, circuit breakers and accessories for security. Check the AC electrical cord and plug for damage. Record the reading of the hour meter on the maintenance check list.
4. Replace the ambient air intake filters at the rear of the ventilator.

CAUTION

Do not use Methyl Ethyl Ketone (MEK) or Tricloroethylene, as damage to surfaces will result. Do not allow any liquid to spill or drip into the ventilator.

Interior Inspection

1. Open the Ventilator.
2. Vacuum all surfaces inside the ventilator. Be sure to reach areas around connectors, circuits boards and pneumatic assemblies.
3. Visually inspect for any overheated components, loose connectors, damaged wires or tubing, kinked tubing, loose ribbon cables, loose or missing hardware, signs of water or other residue inside Tygon tubing, loose Tywraps, poor connector crimps or loose fasteners.

Specifications

Current leakage – 100µA maximum (per UL 544)

Ground resistance – 0.1 ohms at 25.0 A (per UL 544)

WARNING

When replacing Air/02 inlet filters, mark and remove one and only one fitting at a time. Replace the filter and return the fitting to its original location before removing the second fitting. Failure to follow this procedure may result in injury, including death, to the patient.

Calibration and Verification Procedure

Perform Calibration and/or Calibration Verification Procedures as described in chapter 4 of this manual.

CAUTION

Circuit boards are subject to damage by static electricity. Do not touch components, circuit, or connector fingers with hands. Handle only by edges.

Ground Resistance Test

Perform a ground resistance check (follow manufacturer‘s instructions for test equipment operation).

1. Connect a properly functioning leakage and grounding tester between the ground connection and the hospital grade AC plug (middle lug) and the chassis of the ventilator (any unpainted exposed metal part).
2. With the tester connected and operating, there should be no more than 0.10 ohms resistance between the plug ground connector, and the ventilator chassis ground.

Current Leakage Test

Perform a current leakage test (always follow manufacturer‘s instructions for test equipment operation).

1. Connect the ventilator to a properly functioning current leakage tester.
2. Turn Mode switch to CPAP and tester on.
3. Current leakage should be less than 100 microamps, grounded and ungrounded.

Operational Verification Procedure

After Completing the Preventive Maintenance Procedure, perform the Operational Verification Procedure (OVP) per Section 3, of this Manual. Ensure that the ventilator is functioning properly. Complete an Operational Verification Procedure Checklist form and attach it to the PM Checklist form. See the OVP for specific instructions.

Figure 8-1: Ventilator Back Panel

BEAR CUB™ 750vs Infant VENTILATOR

PREVENTIVE MAINTENANCE CHECK LIST

Serial Number_____ Hour meter reading_____ Today's date _____

Service Location	_____	Service Organization	_____
Address	_____	Address	_____
City, State, Zip	_____	City, State, Zip	_____
Contact	_____	Service Person	_____
Phone (___)	_____	Phone (___)	_____

VERIFICATION STEPS

Step	Pass	Fail	Step	Pass	Fail
Inspection/Clean External	☐	☐	Machine Transducer Calibration	☐	☐
Inspection/Clean Interior	☐	☐	Differential Transducer Calibration	☐	☐
Replace Air/O2 Filter	☐	☐	Proximal Transducer Calibration	☐	☐
Replace O-ring	☐	☐	O2 Transducer Calibration	☐	☐
Replace Prox Line Filter	☐	☐	Air Transducer Calibration	☐	☐
Replace Flow Valve Filter	☐	☐	Base Flow Calibration	☐	☐
Replace Solenoid Filter	☐	☐	Inspiratory Flow Calibration	☐	☐
Replace Air Regulator	☐	☐	Verify FiO2	☐	☐
Air-O2 Regulator Calibration	☐	☐	Complete OVP	☐	☐

WARNING

Do not release ventilator for use if it does not pass all of the procedures specified in the checklist. To do so could result in personal injury including death or property damage. Refer the ventilator to a Viasys Service Technician or a Viasys trained Service technician for appropriate repair and/or calibration

Signature_____

Chapter 9 RS-232 Protocol

Scope

This document defines both the hardware and software protocol for the RS-232 communication port on the BEAR® 1000 Adult Ventilator, the BEAR CUB™ 750vs Infant Ventilator, and the BEAR® Graphics Display. Throughout this document the ventilator shall be defined as the SENDING device, that which transmits real time data and responds to requests for data in the form of other parameters. This is true even if the Graphic Display is in place acting as a repeater and providing data to a third device.

Hardware Definition

Connector:	Male 9-pin DSub connector (on the Ventilator).
Duplex:	Full
Baud Rate:	Selectable 1200, 2400, 9600, or 19200
Data:	8-bit character
	1 Start bit, 1 Stop bit
	No parity bit

Pin Assignment

IBM standard 9-pin version of RS-232-C. The ventilator, is DTE and will interface to any DCE device through a cable wired 1 to 1. (See table 9-1).

Table 9-1: Pin Assignment

DTE Name	DTE Pin	Direction	DCE Pin	Comment
DCD	1	<<- - - - - - - -	1	Not used by Ventilator
RxD	2	<<- - - - - - - -	2	
TxD	3	- - - - - - - - ->>	3	
DTR	4	- - - - - - - - ->>	4	
GND	5	- - - - - - - - - -	5	
DSR	6	<<- - - - - - - -	6	Not used by ventilator
RTS	7	- - - - - - - - ->>	7	Tied High @ ventilator
CTS	8	<<- - - - - - - -	8	
RI	9	<<- - - - - - - -	9	Not used by ventilator

Where:
DCD=Data Carrier Detect
RXD=Receive Data
T x D=Transmit Data
DTR=Data Terminal Ready
GND=GROUND
DSR=Data set ready
RTS=Request to send
CTS=Clear to send
RI=Ring indicator

Alternatively, the ventilator can be interfaced to a DTE device with the following "null-modem" interface. (See table 9-2).

Table 9-2: Alternate Pin Assignment

DTE Name	DTE Pin	Direction	DTE Pin	DTE NAME
GND	5	- - - - - - - - - -	5	GND
RxD	2	<<- - - - - - - -	3	TXD
TxD	3	- - - - - - - - ->>	2	RXD
RTS	7	- - - - - - - - ->>	1	DCD
DTR	4	- - - - - - - - ->>	6 & 8	DSR & CTS
RI	9	Not used	9	RI

Software Protocol

The ventilator's RS-232 port has two modes of communication. The first mode continuously outputs real time data every 10 msec and will provide non-real time data upon request from an external device. This mode requires 19.2 kBaud data rate. This second mode will only provide non-real time data upon request from an external device (all other data rates). The mode of communication is selected by the user upon installation simultaneously with and as a function of the baud rate.

Continuous Output (Default Mode)

The continuous output mode communicates at 19.2 kBaud and sends out the real time data (flow, pressure, breath phase, breath type, and alarm status) every 10 msec. Upon request, non-real time data will also be sent, however it may delay the real time data by up to 25 msec. Note, the real time data is queued by the ventilator so that it is only delayed and not lost.

Data Upon Request

All non-real time data, consisting of control settings, alarm settings and status, and monitor values will be provided upon request from an external device. This data can be requested at any transmitted baud rate. The buffer for requested data will be limited, but will have the capability such that at least three (3) transactions (requests) can be handled (queued) at a time. Any additional data requests prior to completion of a corresponding number of message transmissions may be ignored by the ventilator.

Data Format

The messages are sent and received in variable length data packets. All packets are preceded by a SYN character, and terminated by a check sum.

The purpose of the SYN character is to enable the receiver to detect the start of a message, therefore it is an illegal character within a data packet. If the binary value of SYN (16h) or DLE (10h) appears in the data packet (including the Check Sum, see below) an escape sequence will be used. The illegal character will be preceded by the DLE character and 10h will be subtracted from its original value.

The second character in each packet (both transmitted and received) is defined as the ID character. Valid ID characters are defined in tables 9-3, 9-4 and 9-5.

All other ID's are undefined at this time or are for internal use only. Any request for data using an undefined ID will be responded to by either the transmission of undefined data or will be ignored by the ventilator.

The Check Sum [Check] is defined as the one's complement of the sum of all data contained in the data packet excluding the "SYN" and "CHECK" characters.

Table 9-3: Valid Requests Received by the Ventilator

Format: [SYN]	[ID]	[Check]
[SYN]:	16h	
[ID]:	20h	Send all Adult Control Settings
	40h	Send all Adult Alarm Settings/Status
	60h	Send all Adult Monitored Data
	A0h	Send all Infant Control Settings
	C0h	Send all Infant Alarm Settings/Status
	E0h	Send all Infant Monitored Data
[Check]:	Check Sum	

Table 9-4: Valid Message Transmitted by the Ventilator

Format: [SYN]	[ID]	[Data #1] [Data #n] [Check]
[SYN]:	16h	
[ID]:	00h..0Fh	Real Time Data, No Alarms
	10h 1Fh	Real Time Data, Alarm Condition
	20h	Adult Control Settings
	40h	Adult Alarm Settings
	60h	Adult Monitor Settings
	A0h	Infant Control Settings
	C0h	Infant Alarm Settings
	E0h	Infant Monitor Settings
[Data #X]:	Binary Data	
[Check[:	Check Sum	

Table 9-5: Real Time Data

Mode: Continuously, every 10-msec
Length: 6 Bytes

Format:

[SYN] [ID] [Data #1] [Data #3] [Check]

[ID]:

Bit 7 — 0
Bit 6 — 0
Bit 5 — 0 — Alarm Condition
Bit 4 — X
Bit 3 — Y — Breath Type
Bit 2 — Y
Bit 1 — Y — Breath Phase
Bit 0 — Z

Alarm Condition (x):

0 — No Alarm
1 — Alarm

Breath Type (yyy):

000 — Volume
001 — Spontaneous
010 — Pressure Control
011 — Pressure Support
100 — Time Cycled/Pressure Relief
101 — Reserved
110 — Reserved
111 — Reserved

Breath Phase (z):

0 — Inspiration
1 — Exhalation

[Data #1]	**[Data #2]**	**[Data #3]:**
xxxxxxxx	xxxxxyyy	yyyyyyyy
|	| |	|
MSB	LSB\MSB	LSB

x: Net Flow (Insp-Exhale) - 13 bits

Range:	-300 to +300 lpm
Binary Scale:	1 bit = 0.1 lpm
Binary Range:	0 to 6000
Zero offset:	3000

y: Proximal Pressure - 11 bits

Range:	-60 to +140 cmH2O
Binary Scale:	1 bit = 0.1 cmH2O
Binary Range:	0 to 2000
Zero offset:	600

Table 9-6: Adult Ventilator Control Settings

Mode: Upon Request

Length: 16 Bytes

Format:

[SYN] [ID] [Data #1] [Data #13] [Check]

[ID] : 20h

[Data #1] Mode/Wave:

Bit	7 —	x	
Bit	6 —	x	
Bit	5 —	x	
Bit	4 —	y	
Bit	3 —	y	
Bit	2 —	Reserved	(0)
Bit	1 —	Reserved	(0)
Bit	0 —	Reserved	(0)

Mode :

000	—	Assist Control
001	—	SIMV/CPAP/PSV
010	—	Pressure Control
011	—	Reserved
:		:
111	—	Reserved

Wave:

00	—	Square
01	—	Sine
10	—	Decelerating
11	—	Reserved

[Data #2] Switches:

Bit	7 —	100% O2 (1=on, 0=off)
Bit	6 —	Sigh On (1=on, 0=off)
Bit	5 —	Pres Aug (1=on, 0=off)
Bit	4 —	Nebulizer (1=on, 0=off)
Bit	3 —	Reserved (0)
Bit	2 —	Reserved (0)
Bit	1 —	Reserved (0)
Bit	0 —	Reserved (0)

[Data #n]	Parameter	Range	Binary Scale	Binary Range
[Data #3]	Tidal Vol	0.03 - 2.00L	0.01 L	3 - 200
[Data #4]	Rate	0-120 bpm	0.5 bpm	0 - 240
[Data #5]	Peak Flow	5 - 150 lpm	1 lpm	5 - 150
[Data #6]	Percent O2	21 - 100% O2	1% O2	21 - 100
[Data #7]	Assist Sens	0.2 - 5.0 cmH2O	0.1 cmH2O	2 - 50
[Data #8]	PSV/Insp Pres	0 - 80 cmH2O	1 cmH2O	0 - 80
[Data #9]	Insp Pause	0.0 - 2.0 sec	0.1 sec	0 - 20
[Data #10]	MMV	0 - 50 Liters	1 Liter	0 - 50
[Data #11]	Insp Time	0.0 - 5.0 sec	0.1 sec	0 - 50
[Data #12]	CC	0.0 - 7.5 ml/cmH2O	0.1 ml/cmH2O	0 - 75
[Data #13]	Pres Slope	-P9 to P9, -9 to 9	1	1 – 38

Table 9-7: Adult Ventilator Alarm Settings / Status

Mode: Upon Request

Length: 14 Bytes

Format: [SYN] [ID] [Data #1] [Data #13] [Check]

[ID] : 40h

[Data #1] Alarm Status Byte - 1

Bit 7 —	High Min Vol	(1=on, 0=off)
Bit 6 —	Low Min Vol	(1=on, 0=off)
Bit 5 —	High Insp Pres	(1=on, 0=off)
Bit 4 —	Low Insp Pres	(1=on, 0=off)
Bit 3 —	High Base Pres	(1=on, 0=off)
Bit 2 —	Low Base Pres	(1=on, 0=off)
Bit 1 —	High Rate	(1=on, 0=off)
Bit 0 —	Low Rate	(1=on, 0=off)

[Data #2] Alarm Status Byte - 2

Bit 7 —	I:E Limit	(1=on, 0=off)
Bit 6 —	Run Diagnostics	(1=on, 0=off)
Bit 5 —	Gas Fail	(1=on, 0=off)
Bit 4 —	Failed to Cycle	(1=on, 0=off)
Bit 3 —	Reserved	(0)
Bit 2 —	Reserved	(0)
Bit 1 —	Reserved	(0)
Bit 0 —	Alarm Silence	(0)

[Data #n]	Parameter	Range	Binary Scale	Binary Range
[Data #3]	High Min Vol	0 - 80 L	1 L	0 - 80
[Data #4]	Low Min Vol	0 - 50 L	1 L	0 - 50
[Data #5]	High Insp Pres	0 - 120 cmH2O	1 cmH2O	0 - 120
[Data #6]	Low Insp Pres	3 - 99 cmH2O	1 cmH2O	3 - 99
[Data #7]	High Base Pres	0 - 55 cmH2O	1 cmH2O	0 - 55
[Data #8]	Low Base Pres	0 - 50 cmH2O	1 cmH2O	0 - 50
[Data #9]	High Rate	0 - 155 bpm	1 bpm	0 - 155
[Data #10]	Low Rate	3 - 99 bpm	1 bpm	3 - 99
[Data #11]	I:E Override	on/off	n/a	1/0

Table 9-8: Adult Ventilator Monitor Status

Mode: Upon Request

Length: 18 Bytes

Format:
[SYN] [ID] [Data #1] [Data #15] [Check]

[ID] : 60h

[Data #1] Breath Data

Bit 7	—	Control Breath	(1=on, 0=off)
Bit 6	—	Sigh Breath	(1=on, 0=off)
Bit 5	—	Patient Effort	(1=on, 0=off)
Bit 4	—	MMV Active	(1=on, 0=off)
Bit 3	—	Reserved	(0)
Bit 2	—	Reserved	(0)
Bit 1	—	Reserved	(0)
Bit 0	—	Reserved	(0)

[Data #n]	Parameter	Range	Binary Scale	Binary Range
[Data #2]	MSB Tidal Vol	0 - 9.99 L	0.01 L	0 - 999
[Data #3]	LSB " "			
[Data #4]	MSB Minute Vol	0 - 99.9 L	0.1 L	0 - 999
[Data #5]	LSB " "			
[Data #6]	MSB Spon Min Vol	0 - 99.9 L	0.1 L	0 - 999
[Data #7]	LSB " "			
[Data #8]	MSB 1/I:E Ratio	0.00 - 4.0	0.01	0 - 400
[Data #9]	LSB " "			
[Data #10]	Total Rate	0 - 155 bpm	1 bpm	0 - 155
[Data #11]	Spon Rate	0 - 155 bpm	1 bpm	0 - 155
[Data #12]	%MMV	0 - 100 %/hr	1 %/hr	0 - 100
[Data #13]	Mean Pres	0 - 140 cmH2O	1 cmH2O	0 - 140
[Data #14]	Peak Pres	0 - 140 cmH2O	1 cmH2O	0 - 140
[Data #15]	Plateau Pres	0 - 140 cmH2O	1 cmH2O	0 – 140

Table 9-9: Infant Ventilator Control Settings

Mode: Upon Request

Length: 14 Bytes

Format:
[SYN] [ID] [Data #1] [Data #11] [Check]

[ID] : A0h

[Data #1] Mode & Switches
Bit 7 — x
Bit 6 — x
Bit 5 — x
Bit 4 — Pressure Settings Incompatible (1=on, 0=off)
Bit 3 — Flow Settings Incompatible (1=on, 0=off)
Bit 2 — Rate/Time Settings Incompatible (1=on, 0=off)
Bit 1 — Manual Breath (1=on, 0=off)
Bit 0 — Reserved (0)

Mode:
000 — Assist Control
001 — SIMV/IMV
010 — CPAP
011 thru 111 — Reserved

[Data #n]	Parameter	Range	Binary Scale	Binary Range
[Data #2]	Breath Rate	0 - 150 BPM L	1 BPM	0 - 150
[Data #3]	Insp Time MSB	0.10 -3.00 sec	0.01 sec	10 - 300
[Data #4]	Insp Time LSB	"	"	"
[Data #5]	Volume Limit MSB	5 - 300 mL	1 mL	5 - 300
[Data #6]	Volume Limit LSB	"	"	"
[Data #7]	Insp Flow	1 - 30 L/min	0.5 L/min	2 - 60
[Data #8]	Base Flow	1 - 30 L/min	0.5 L/min	2 - 60
[Data #9]	Assist Sens	0.2 - 25.5 L/min	0.1 L/min	2 - 255
[Data #10]	Insp Pres	Reserved		0
[Data #11]	PEEP/CPAP	Reserved		0

Table 9-10: Infant Ventilator Alarm Settings/Status

Mode:	Upon Request
Length:	10 Bytes
Format: [SYN] [ID]	[Data #1] [Data #7] [Check]
[ID] :	C0h
[Data #1]	Alarm Status Byte-1 Bit 7 — High Breath Rate (1=on, 0=off) Bit 6 — Low Breath/CPAP (1=on, 0=off) Bit 5 — Low Inspiratory Pressure (1=on, 0=off) Bit 4 — Apnea (1=on, 0=off) Bit 3 — Patient Circuit Fault (1=on, 0=off) Bit 2 — Prolonged Insp Pres (1=on, 0=off) Bit 1 — High Pressure Limit (1=on, 0=off) Bit 0 — Reserved (0)
[Data #2]	Alarm Status Byte-2 Bit 7 — Flow Sensor Fault (1=on, 0=off) Bit 6 — Run Diagnostics (1=on, 0=off) Bit 5 — Low Gas Supply (1=on, 0=off) Bit 4 — Low Battery Supply (1=on, 0=off) Bit 3 — Failed to Cycle (1=on, 0=off) Bit 2 — Reserved (0) Bit 1 — Reserved (0) Bit 0 — Alarm Silence (1=on, 0=off)

[Data #n]	**Parameter**	**Range**	**Binary Scale**	**Binary Range**
[Data #3]	High Breath Rate	0 - 255 BPM	1 BPM	0 - 255
[Data #4]	Low PEEP/CPAP	-10 - 50 cmH2O	1 cmH2O	0 - 60
[Data #5]	Low Insp Pres	3 - 99 cmH2O	1 cmH2O	3 - 99
[Data #6]	High Pressure Limit	15 - 85 cmH2O	1 cmH2O	15 - 85
[Data #7]	Apnea	5 - 30 sec	1 sec	5 – 30

Table 9-11: Infant Ventilator Monitor Status

Mode:	Upon Request				
Length:	20 Bytes				
Format:					
[SYN]	[ID]	[Data #1]	[Data #11]	[Check]	
[ID] :	E0h				
[Data #1]	Breath Data				
	Bit 7 — Control Breath			(1=on, 0=off)	
	Bit 6 — Patient Effort			(1=on, 0=off)	
	Bit 5 — Reserved			(0)	
	Bit 4 — Reserved			(0)	
	Bit 3 — Reserved			(0)	
	Bit 2 — Reserved			(0)	
	Bit 1 — Reserved			(0)	
	Bit 0 — Reserved			(0)	
[Data #n]	**Parameter**	**Range**	**Binary Scale**	**Binary Range**	
[Data #2]	Tidal Volume MSB	0 - 500 mL	1 mL	0 - 500	
[Data #3]	Tidal Volume LSB	"	"	"	
[Data #4]	Minute Volume MSB		0 - 30.0 L	0.1 L	0 - 300
[Data #5]	Minute Volume LSB	"	"	"	
[Data #6]	% Tube Leak	0 - 100%	1%	0 - 100	
[Data #7]	Insp Time MSB	0 - 3.10 sec	0.01sec	0 - 310	
[Data #8]	Insp Time LSB	"	"	"	
[Data #9]	Exp Time MSB	0 - 99.99 sec	0.01 sec	0 - 9999	
[Data #10]	Exp Time LSB	"	"	"	
[Data #11]	I:E Ratio				
	[Bit 7=Direction]	1 if 1:X.X, 0 if X.X:1			
[Data #12]	Breath Rate	0 - 255 bpm	1 bpm	0 - 255	
[Data #13]	Peak Insp Pres	0 - 99 cmH20	1 cmH20	0 - 99	
[Data #14]	Mean Pres MSB	0 - 99.9 cmH20	0.1 cmH20	0 - 999	
[Data #15]	Mean Pres LSB	"	"	"	
[Data #16]	Air Supply Pres	0 - 99 psig	1 psig	0 - 99	
[Data #17]	O2 Supply Press	0 - 99 psig	1 psig	0 – 99	

Chapter 10 Parts List

Pneumatic Sub Assembly

Auxiliary Pressure Relief Valve	51000-04668
Air/O2 inlet Manifold Assembly	51000-09302
Oxygen Blender Assembly	51000-09303
PEEP Valve Assembly	51-09308-01
Pressure Limit Valve Assembly	51-09308-02
Flow Control Valve	51000-09573
Exhalation Valve Assembly	51000-09363
Sub-Ambient Over Pressure Relief Valve	51000-40023
Pressure Control Assembly	51000-09484
Proximal Pressure Gauge	52000-00216

Electronic Sub Assemblies

Power Supply Module (Includes Power Supply PCB)	51000-09301
Power Supply PCB	51000-09317
Display PCB	51000-09567
Control PCB	51000-09939
Flow Sensor Connector Assembly	51000-09353
Alarm Speaker Assembly	51000-09488
Battery, Sealed, Lead Acid, 12 VDC	51000-09530

Miscellaneous

Knob, Front Panel	51000-09461
Knob, Rear Panel, Apnea-Alarm Volume	51000-00261
Knob, Mode Select	51000-09514
Knob, Oxygen Blending	56000-00268
Fuse, 0.5A, Slow Blow	56000-20079
AC Power Cord	56090-10540

Chapter 11 Repackaging Instructions

General

The packaging system for the BEAR CUB™ 750vs Infant Ventilator has been designed to provide a high degree of protection against shipping damage.

All shipments of BEAR CUB™ 750vs Infant Ventilators should be made using the complete packaging system.

Allied Healthcare Products, Inc., does not assume any liability whatsoever for any damage incurred in any product returned to our facilities by any means. The shipper and carrier are totally responsible for all damage and costs involved in transporting returned goods. If a package is damaged in shipment, your shipper and/or carrier should be notified within ten days of receipt of the shipment.

Packaging Instructions

NOTE

It is advisable that a shipping department or organization perform this procedure. A local freight company will usually pack the product at your facility for a small service charge.

The packaging carton consists of:

Accessory Carton	51000-09505
Anti-static Bag 26"x22"x44"	51000-06056
Cavity pack-bottom	51-09504-02
Cavity pack-top	51-09504-01
Shipping Carton	51000-09502
Shipping Label	51000-20038

Procedure

1. Place a large plastic bag over the ventilator.
2. Attach a shipper to the plastic bag with tape.
3. Place the accessory carton inside the shipping carton.
4. Align the bottom portion of cavity-pack so it slides in place inside the carton.
5. Place the ventilator in the carton, align the ventilator so it slides into the cavity-pack bottom.
6. Align the top portion of the cavity-pack on top of the ventilator.
7. Seal the box top flaps with heavy duty packaging tape.

Figure 11-1: Packaging System Diagram

Addendum A: Release 4 Software

Addendum B: Bear Cub 750 PSV Infant Pediatric Ventilator System

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